

STEEL CASTINGS HANDBOOK

SUPPLEMENT 10

A GLOSSARY OF FOUNDRY TERMS



STEEL FOUNDERS'
SOCIETY OF AMERICA

STEEL CASTINGS HANDBOOK SUPPLEMENTS

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**A GLOSSARY
of
Foundry Terms**

This supplement was developed as a glossary of terms used in the Fifth Edition of the **Steel Castings Handbook** published by The Steel Founders' Society of America. It is not, therefore, intended to be an inclusive glossary of all foundry terms.

It is, however, useful on its own as a reference piece as it does incorporate the vast majority of foundry terms.

Glossary of Foundry Terms

A

AAR . . . Association of American Railroads, American Railroad Bldg., 1920 L St. NW, Washington, D.C. 20036.

Abrasion Resistance . . . Degree of resistance of a material to abrasion or wear.

Abrasive Wear . . . The displacement and/or detachment of metallic particles from a surface as a consequence of being exposed to flowing fluids, gases, or solids.

Abrasives . . . Materials for grinding, polishing, blasting, either in loose form or bonded to form wheels, bricks, or files, or applied to paper and cloth by glue or resin. Natural abrasives include emery, corundum, garnet, sand, flint, etc. Metallic shot and grit are also used as abrasives in cleaning castings.

Accelerator . . . A substance that hastens a reaction usually acting as a catalyst; as used in sand additive resins.

Acid . . . A term applied to slags, refractories, and minerals containing a high percentage of silica.

Acid Brittleness (Pickling Brittleness) . . . Lack of ductility, induced in steel when it is pickled in dilute acid to remove scale—commonly attributed to the absorption of hydrogen.

Acid Embrittlement . . . Embrittlement during pickling due to absorption of hydrogen.

Acid Process . . . A steelmaking method using an acid refractory-lined furnace. Neither sulfur nor phosphorus is removed.

Adapti Investment Casting Process . . . A lost wax process employing one of three methods: centrifugal, vacuum or gravity-pouring casting.

Adeline Steelmaking Process . . . Method of producing precision castings of steel or steel alloys using aluminothermic process and lost wax, followed by centrifugal action.

Addition Agent . . . 1) Any material added to a charge of molten metal in bath or ladle to bring alloy to specifications, 2) reagent added to plating bath.

Additive . . . Any material added to molding sand for reasons other than bonding; e.g., seacoal, pitch, graphite, cereals.

Aeration . . . Making contact between air and a liquid by spraying liquid into the air or by agitating the liquid to promote absorption of air. Also act of fluffing molding sand.

AFS Tests . . . A number of standard tests determined by American Foundrymen's Society to evaluate molding and core sands.

Age Hardening . . . Hardening by aging, usually after rapid cooling. See also Aging.

Aging . . . A change in properties of alloys which occurs slowly at room temperature and will proceed rapidly at higher temperatures. See also Age Hardening.

Air Furnace . . . Reverberatory-type furnace in which metal is melted by heat from fuel burning at one end of the hearth, passing over the bath toward the stack at the other end. Heat also is reflected from the roof and side walls.

Air-Hardening Steel . . . A steel containing sufficient alloy to fully harden during cooling in air. Typically this term is restricted to steels being able to harden in sections of about 2 in. (51 mm) or more.

Air Quenching . . . Accelerated cooling of alloys in an air stream from temperatures above the AC_3 transformation temperature.

Air Scale . . . Scale left on ferrous metal in processing, usually from heating in presence of air.

Airblasting . . . A cleaning operation, as cleaning sand from molds.

Alkaline Derusting . . . An electrical process for derusting steel, cast iron and other ferrous alloys without using heat.

Allowance (Tolerance) . . . In a foundry, the clearance specified; difference in limiting sizes, as minimum clearance or maximum interference between mating parts, as computed arithmetically.

Alloy . . . 1) A substance having metallic properties and composed of two or more chemical elements of which at least one is metal. Usually possesses qualities different from those of the components, 2) in minting, the base-metal added.

Alloy Steel . . . Steel containing significant quantities of alloying elements other than carbon and the commonly accepted amounts of manganese, silicon, sulfur, and phosphorus.

Alpha Martensite . . . A form or stage of martensite of somewhat arbitrary distinction, probably representing the least developed and most distorted stage in the transformation of austenite to martensite at ordinary temperatures.

Alpha Process . . . A shell molding and core-making method in which a thin resin-bonded shell is baked with a less expensive, highly permeable material.

Alternating Stress . . . Stress produced in a material by forces acting alternately in opposite directions.

Ambient Air . . . The surrounding air.

Ambient Temperature . . . Temperature of the surrounding air.

American Foundrymen's Society . . . Golf and Wolf Roads, Des Plaines, IL. 60016.

Ames Portable Hardness Tester . . . The Rockwell penetration method of testing hardness of metals can be made with this tester by applying pressure to the penetrator by screw action.

Analysis Line . . . In spectrographic analysis, the particular spectral line used in determining the concentration of an element.

Angle Testing . . . A method of ultrasonic testing using shear waves introduced from the surface of the material at approximately 45 degrees.

Anisotropy . . . The characteristic of exhibiting different property values in different directions with respect to a fixed reference system in the material.

Annealing . . . Heating to and holding at a suitable temperature, followed by cooling at a suitable rate to lower the hardness or alter other mechanical or physical properties.

Anticarburing Compounds . . . Compounds applied to metallic surfaces to prevent surface carburization.

Apparent Contraction . . . The net contraction of a casting dimension due to true metal contraction and initial expansion due to mold wall movement.

Arc Cutting . . . Using an electric arc to cut metal.

Arcair Torch . . . An electric arc torch with air ducts running parallel to the electrode, used to remove metal and surface defects from ferrous castings.

ARD Process . . . A refinement of the precision casting process, using plastic patterns produced in automatic injection machines.

Arnold's Fatigue Test . . . (after John Arnold, Brit. Met.), a test for fractures using 850 cyclic stress reverses per min., recording the number of cycles required to produce fracture.

Artificial Aging . . . An aging treatment above room temperature. See Aging and Age Hardening.

As Cast (as-cast, u.m.) . . . Referring to metal which has not received finishing (beyond gate removal or sandblasting) or treatment of any kind including heat treatment after casting. Similarly, as drawn, as forged and as rolled.

ASM . . . American Society for Metals, Rt 87, Novelty, OH 44072.

ASNT . . . American Society for Nondestructive Testing, 3200 Riverside Dr., Columbus, OH 43221.

ASTM . . . American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.

Atmosphere, Furnace . . . Gases with which metal is in contact during melting or heat treating.

Atmosphere, Neutral . . . Furnace atmosphere made up of an inert gas as argon or where the products of combustion are neither oxidizing nor reducing in contact with the metal being heated.

Atmosphere, Oxidizing . . . Furnace atmosphere which gives off oxygen under certain conditions or where there is an excess of oxygen in the product of combustion, or the products of combustion are oxidizing to the metal being heated.

Atmosphere, Reducing . . . Furnace atmosphere which absorbs oxygen under suitable conditions or in which there is insufficient air to completely burn the fuel, or the product of combustion is reducing to the metal being heated.

Austenite . . . The face-centered-cubic phase of iron and steel, also referred to as gamma iron. In steel, a solid solution in which gamma iron is the solvent.

Austenitic Steels . . . Any steel containing sufficient alloy to produce a stable austenitic (gamma iron) crystalline structure at ambient temperatures.

B

Backing Board (backing plate) . . . A second bottom board on which molds are opened.

Bainite . . . In steel, an acicular aggregate of ferrite and carbide.

Bake . . . Heat in an oven to a low controlled temperature to remove gases or to harden a binder.

Baked Core . . . A core which has been heated through sufficient time and temperature to produce the desired physical properties attainable from its oxidizing or thermal-setting binders.

Ball Burnishing . . . 1) A method of obtaining a high luster on small parts by rotating them in a wooden-lined barrel with water, burnishing soap, and stainless steel shot, 2) see ball sizing.

Band, Inside . . . A loose steel frame placed inside a removable flask to reinforce the sand at the parting line after the flask has been removed.

Bark . . . The decarburized layer just beneath the scale resulting from heating steel in an oxidizing atmosphere.

Bars (Cleats) . . . Ribs of metal or wood placed across the flask to help support the sand in the cope.

Base Plate . . . A plate to which the pattern assemblies are attached and to which a flask is subsequently attached to form the mold container.

Batch . . . Amount or quantity of core or mold sand or other material prepared at one time. Computer and EDP term meaning to group together.

Batch Oven . . . Oven used to bake a number of cores at one time.

Bath . . . Molten metal on the hearth of a furnace, in a crucible, or in a ladle.

Batten . . . A wooden bar or strip fastened to bottom or follow board for rigidity or to prevent distortion during ramming of the mold.

Bead . . . 1) Half-round cavity in a mold, or half-round projection or molding on a casting, 2) a single deposit of weld metal produced by fusion.

Beam and Sling . . . Tackle used in conjunction with a crane for turning over the cope or drag of a mold prior to assembly.

Bedding . . . Sinking a pattern down into the sand to the desired position and ramming the sand around it.

Bedding a Core . . . Resting an irregular-shaped core on a bed of sand for drying.

Bed-In . . . Method whereby drag may be rammed in the pit or flask without necessity of rolling over. Process used in production of heavy castings.

Bench-Blower . . . A small core-blowing machine, utilizing a removable sand magazine and blow head.

Bench Rammer . . . A short rammer used by bench molders.

Bending Strength . . . Upper limit of normal stress of a beam at which fracture or excessive plastic deformation occurs.

Bentonite . . . A colloidal clay derived from volcanic ash and employed as a binder in connection with synthetic sands, or added to ordinary natural (clay-bonded) sands where extra strength is required.

BHN . . . Brinell Hardness Number.

Bimetal . . . Casting, usually centrifugal, made of two different metals, fused together.

Black Lead . . . A natural form of graphite used for sleeking green sand molds, or applied as a water suspension to skin dried molds.

Blackening Scab . . . A form of casting defect related to an improper coating rather than to the sand.

Blackening Carbon . . . Carbonaceous materials such as plumbago, graphite or powdered coke usually mixed with a binder and frequently carried in suspension in water or other liquid; used as a thin facing applied to surfaces of molds or cores to improve casting finish.

Blackening Holes . . . Irregular-shaped surface cavities in a casting containing carbonaceous matter. Caused by spalling off of the blackening from the mold surface.

Blackening Scab . . . A casting defect formed by blackening flaking off due to sand expansion and being retained in or on the surface of the metal.

Blasting (Blast Cleaning) . . . A process for cleaning or finishing metal objects by use of an air blast or centrifugal wheel that throws abrasive particles against the surface of the work pieces. Small, irregular particles of steel or iron are used as the abrasive in grit blasting; and in sandblasting, and steel or iron balls in shot blasting.

Bleeder . . . A defect wherein a casting lacks completeness due to molten metal draining or leaking out of some part of the mold cavity after pouring has stopped.

Blended Molding Sands . . . Naturally bonded molding sands which have been mixed or modified by the supplier to produce desirable properties.

Blister . . . A shallow blow with a thin film of the metal over it appearing on the surface of a casting.

Blocking . . . Adding ferromanganese or other deoxidizing agent to an open hearth bath to stop all oxidizing reactions.

Blow Holes . . . Holes in the head plate or blow plate of a core-blowing machine through which sand is blown from the reservoir into the core box.

Blow Plate . . . The plate containing the core sand entrance holes or blow holes used in open-face core boxes.

Blower, Core or Mold . . . A device using air pressure to fill a corebox or flask with sand.

Blowholes (Blows) . . . Irregular shaped cavities with smooth walls produced in a casting when gas, entrapped while the mold is being filled, or evolved during solidification of the metal, fails to escape and is held in pockets within the metal.

Blowing-Off a Mold . . . Cleaning a mold cavity with a stream of compressed air.

Blowpipe . . . A small pipe or tube through which the breath is blown in removing loose sand from small mold cavities.

Blows . . . See Blowholes.

Bluing . . . Formation of a thin film of oxide on polished steel to improve its appearance and protect its surface.

Blunging . . . Mixing clay with water to a creamy slip.

Bob . . . A riser or feeder, usually blind, to provide molten metal to the casting during solidification, thereby preventing shrinkage cavities.

Body Core . . . The main core.

Boil . . . Agitation of a bath of metal caused by the liberation of a gas beneath its surface usually resulting

in formation of dross. May be caused by a wet furnace bottom or ladle or by dirty or cold ingots, or may be deliberately induced by the addition of oxidizing material to a bath containing excess carbon. In the latter case it is called a carbon boil and CO or CO₂ are liberated.

Bond . . . 1) Bonding substance or bonding agents—any material other than water, which, when added to foundry sands, imparts bond strength, 2) the overlapping of brick so as to give both longitudinal and transverse strength.

Bond Strength . . . Property of a foundry sand to offer resistance to deformation.

Bonding Clay (Bonderise) . . . Any clay suitable for use as a bonding material.

Boring . . . A machining method using single point tools on internal surfaces of revolution.

Boss (Pad) . . . A projection of circular cross-section on a casting. Usually intended for drilling and tapping for attaching parts.

Bottom Pour Ladle . . . See Ladle, Bottom Pour.

Bottom Running or Pouring . . . Filling of the mold cavity from the bottom by means of gates from the runner.

Bracket . . . Strengthening strip, rib, or projection on a casting.

Breaker Ring . . . An intentionally weak ring within mass of a ring shell mold to be broken by force of casting shrinkage. Prevents hot tear stress.

Breakoff Notch . . . A thinner section of a gate or riser to facilitate and ensure clean breaking-off during the cleaning process of casting.

Bright Annealing . . . A process carried out usually in a controlled furnace atmosphere, so surface does not oxidize, remaining bright.

Brinell Hardness . . . The value of hardness of a metal on an arbitrary scale representing kg/mm², determined by measuring the diameter of the impression made by a ball of given diameter applied under a known load. Values are expressed in Brinell Hardness Numbers, BHN.

Brittle Fracture . . . Fracture with little or no plastic deformation.

Brittleness . . . A tendency to fracture without appreciable deformation.

Broaching . . . Smoothing machined holes or outside surfaces of castings by drawing or pushing one or more broaches (special cutting tools) through the roughed out hole.

Buckle . . . 1) Bulging of a large flat face of a casting; in investment casting, caused by dip coat peeling from the pattern, 2) an indentation in a casting, resulting

from expansion of the sand, may be termed the start of an expansion defect.

Builtup Plate . . . See Matchplate. A pattern plate of suitable material, with the cope pattern mounted on or attached to one side; the drag pattern may be attached to the other side or to a separate mounting.

Bulk Density . . . The ratio of the weight of a material to its over-all volume (including any inherent porosity).

Bull Ladle . . . See Ladle, Bull.

Bumper . . . Machine for ramming sand in a flask by repeated jarring or jolting.

Burn . . . 1) Process of cutting metal by a stream of oxygen, 2) to permanently damage a metal or alloy by heating to cause either incipient melting or intergranular oxidation.

Burned Sand . . . Sand in which the binder or bond has been removed or impaired by contact with molten metal.

Burned-On-Sand . . . A misnomer usually indicating metal penetration into sand resulting in a mixture of sand and metal adhering to the surface of a casting. See Penetration, Metal.

Burning In . . . See Penetration, Metal.

Burnishing . . . Developing a smooth finish on a metal by tumbling or rubbing with a polished hand tool.

Burnthrough . . . In shell molding, resin burned out too soon.

Butt-Off . . . Operation performed at times to supplement ramming by jolting, either hand or air rammer.

Butt Rammer . . . The flat end of the molder's rammer.

C

C . . . Degrees Centigrade or Celsius.

C or Croning Process . . . See Shell Molding.

Calcium Silicide . . . An alloy of calcium, silicon, and iron used for deoxidation of steel.

Calcium Silicon . . . An alloy of calcium, silicon, and iron containing 28–35% Ca, 60–65% Si, and 6% Fe, max., used as a deoxidizer and degasser for steel and cast-iron; sometimes called calcium silicide.

Camber . . . Deviation from edge straightness usually referring to the greatest deviation of side edge from a straight line.

Carbide . . . A compound of carbon with one or more metallic elements.

Carbon . . . Element occurring as diamond and as graphite, and forming a constituent of coal, petroleum, and asphalt; carbon is also obtained artificially as lampblack, bone black, etc., as charcoal and as coke.

Carbon reduces many metals from their oxides when heated with the latter, and small amounts of it greatly affect the properties of iron. Though classed as a nonmetallic, metallurgically, like boron, it is treated as a metal.

Carbon, Combined . . . The carbon in iron or steel which is combined with other elements and therefore is not in the free state as graphite or as temper carbon.

Carbon Dioxide Process (Silicate Process, Schmidt-Philipp Process) . . . A process for hardening molds or cores in which carbon dioxide gas is blown through dry clay-free silica sand to precipitate silica in the form of a gel from the sodium silicate binder.

Carbon Sand . . . A molding aggregate consisting principally of carbon (graphite) granules.

Carbonitriding (Nicarboning) . . . A process in which a ferrous alloy is case hardened by first being heated in a gaseous atmosphere of such composition that the alloy absorbs carbon and nitrogen simultaneously, and then being cooled at a rate that will produce desired properties.

Case . . . The surface layer of an iron-base alloy which has been suitably altered in composition and can be made substantially harder than the interior or core by heat treatment.

Case Hardening . . . A process of hardening a ferrous alloy so that surface layer or case is made substantially harder than the interior or core. Typical case hardening processes are carburizing and quenching, cyaniding, carbonitriding, nitriding, induction hardening, and flame hardening.

Cast-Weld . . . Welding one casting to another to form a complete unit.

Casting Drawing . . . An engineering drawing which depicts the shape and size of a part to be cast.

Casting Layout . . . A check of dimensions against applicable drawings and specifications.

Cementite . . . A compound of iron and carbon known as iron carbide which has the approximate chemical structure, Fe_3C . It is characterized by an orthorhombic crystal structure.

Centrifugal Casting . . . Casting made in molds which are rotating so as to produce a centrifugal force in the solidifying casting.

Charpy Impact Test . . . Test in which a specimen supported at both ends as a simple beam is broken by the impact of the swinging pendulum. The energy absorbed in breaking the notched specimen, as determined by the decreased rise of the pendulum, is a measure of the impact strength of the metal.

Chill . . . A metal insert in molds or cores at the surface of a casting or within the mold to hasten solidification of heavy sections and cause the casting to cool at a uniform rate.

CMF . . . Cast Metals Federation, 20611 Center Ridge Road, Rocky River, OH 44116.

Coalescence . . . 1) the growth of particles of a dispersed phase by solution and reprecipitation, 2) the growth of grains by absorption of adjacent undistorted grains.

Cobalt . . . Blue-white metal, melting at 2715°F (1492°C), used in very hard alloys such as stellite, and a binder in carbide cutting tools.

Cobalt-60 . . . A radioactive isotope used in medical and industrial radiography.

Cocoon Process . . . A method of protecting metal parts by spraying on a cover of plastic filaments.

Code . . . In EDP, a system of symbols and their use in representing rules for handling the flow or processing of information.

Code Holes . . . The information holes in perforated tape, as opposed to feed or sprocket holes.

Coefficient of Expansion . . . Unit increase in size resulting from a unit increase in temperature; measured in inches per inch per degree of temperature.

Coercive Force . . . The magnetizing force that must be applied in the direction opposite to that of the previous magnetizing force in order to remove residual magnetism; thus, an indicator of the strength of magnetically hard materials.

Cohesion . . . The force by which like particles are held together. It varies with different metals and depends upon hot or cold working as well as upon molecular arrangement due to heat treatment.

Coining . . . 1) A process of straightening and sizing castings by die pressing, 2) a process for shaping metal.

Coke . . . A porous, gray infusible product resulting from the dry distillation of bituminous coal, petroleum or coal tar pitch, which drives off most of the volatile matter. Used as a fuel in cupola melting.

Coke Bed . . . First layer of coke placed in the cupola. Also the coke as the foundation in constructing a large mold in a flask or pit.

Coke, Beehive . . . Coke produced from a bituminous coal by the beehive process where heat for the coking process comes from a partial combustion of the coke. Generally characterized by an elongated stringy structure.

Coke Breeze . . . Fines from coke screenings, used in blacking mixes after grinding; also briquetted for cupola use.

Coke, By-Product . . . Coke produced from bituminous coal in airtight coke ovens where heat for coking process is externally applied. Generally more uniform in size than beehive coke, and usually ball or cube shape.

Coke Furnace . . . Type of pot or crucible furnace using coke as the fuel.

Coke, Petroleum . . . Residue left from the distillation of petroleum crudes, used as a carbon raiser.

Coke Porosity . . . The percentage volume of cell space in coke.

Cold Box Process . . . A two-part organic resin binder system mixed in conventional mixers and blown into shell or solid core shapes at room temperature. A vapor mixed with air is blown into the core, permitting instant setting and immediate pouring of metal around it.

Cold Chamber Machine . . . A diecasting machine where the metal chamber and plunger are not immersed in hot metal.

Cold Chamber, Club Sandwich, Two-Faced, Three-Piece Die . . . A diecasting die in which two different pieces are cast in two widely separated cavities.

Cold Cracking . . . Cracks in cold or nearly cold metal due to excessive internal stress caused by contraction. Often brought about when the mold is too hard or casting is of unsuitable design.

Cold Lap . . . Wrinkled markings on the surface of an ingot or casting from incipient freezing of the surface and too low a casting temperature.

Cold Setting Process . . . Any of several systems for bonding mold or core aggregates by means of organic binders, relying upon the use of catalysts rather than heat for polymerization (setting).

Cold-Setting Binders . . . Term used to describe any binder that will harden the core sufficiently at room temperature so core can be removed from its box without distortion; commonly used in reference to oil-oxygen type binders.

Cold Short . . . A characteristic of metals that are brittle at ordinary or low temperatures.

Cold Shot . . . Small globule of metal embedded in but not entirely fused with the casting.

Cold Shut . . . Casting defect caused by imperfect fusing or discontinuity of molten metal coming together from opposite directions in a mold, or due to folding of the surface. It may have the appearance of a crack or seam with smooth, rounded edges.

Cold Work . . . Plastic deformation of a metal at such temperatures and rates that substantial increases occur in the strength and hardness.

Collapsible Sprue . . . A sprue pattern of flexible material, or of spring-tube design, used in squeeze-molding of plated patterns, and incorporating a pouring cup.

Collate . . . 1) to merge items from two or more similarly sequenced files into one sequenced file, 2) to compare one thing critically with another of the same kind.

Collimator . . . A device for confining the elements of a beam of radiation within an assigned solid angle.

Colloids, Colloidal Material . . . Finely divided material less than 0.5 micron (0.00005 in.) in size, such as albumin, glue, starch, gelatin, and bentonite.

Colloidal Clay . . . Finely divided clay of montmorillonite, kaolinite, or illite class; prepared for foundry purposes as in sand bonding.

Color Etching . . . A micro-etch resulting from the formation of a thin film of a definite compound of the metal.

Colorimetric Analysis . . . Determining the amount of an element in a solution by measuring the intrinsic color.

Columnar Structure . . . A coarse structure of parallel columns of grains, which is caused by highly directional solidification resulting from sharp thermal gradients.

Combination Die (Multiple-Cavity Die) . . . In die casting, a die with two or more different cavities for different castings.

Combined Carbon . . . Carbon in iron and steel which is combined chemically with other elements; not in the free state as graphitic or temper carbon.

Combined Water . . . That water in mineral matter which is chemically combined and driven off only at temperatures above 230 F (110 C).

Combustion . . . Chemical change as a result of the combination of the combustible constituents of the fuel with oxygen, producing heat.

Combustion Chamber . . . Space in furnace where combustion of gaseous products from fuel takes place.

Combustion Efficiency . . . The amount of heat usefully available divided by the maximum amount which can be liberated by combustion; usually expressed in percentage.

Comfort Zone (Average) . . . The range of effective temperatures over which the majority (50% or more) of adults feel comfortable.

Command . . . In EDP, a pulse, signal, or set of signals initiating one step in the performance of a computerized operation.

Common Language . . . In EDP, a machine-sensible information representation common to a related group of data processing machines.

Composite Construction . . . See Cast-Weld (Welding a steel casting to a rolled or forged steel object or to another casting.)

Compression Test . . . Imposing a dead load on a small cylindrical test piece to determine compressive strength, expressed in pounds per sq. in.

Compressive Strength—(Yield) . . . The maximum

stress that a metal, subjected to compression, can withstand without a predefined amount of deformation (ultimate), the maximum stress that a brittle material can withstand without fracture when subjected to compression, compressive strength, sand—maximum stress in compression which a sand specimen is able to withstand without failure.

Compressor . . . Device for providing gas under pressure. Usually connotes high pressures and not so high volume.

Concalenate . . . In EDP, to unite in a series, link in a chain.

Condensing Rings . . . A special form of chill used for cast iron to produce a dense but graphite structure.

Conductivity (Thermal) . . . The quantity of heat that flows through a material measured in heat units per unit time per unit of cross-sectioned area per unit of length, (electrical) the quantity of electricity that is transferred through a material of known cross-section and length.

Connor Gate (Runner) (Lip Feeder) . . . A runner in which the feed block overlaps the casting by 1/16 in. (1.6 mm).

Constant Intensity Pyrometer . . . Use of a comparison lamp filament's glow to estimate metal temperature.

Constantan . . . An alloy of nickel and copper used in thermocouples.

Constituent . . . A micrographically distinguishable part of an alloy or mixture.

Consumer's Risk . . . The risk the consumer runs of accepting lots of quality p2.

Contact Cement . . . Patternmaking bonding technique, in which liquid bonding agent is painted on both surfaces to be joined and allowed to dry. These dry surfaces placed in contact adhere firmly.

Contact Printing (Ink Print) . . . A method of recording details of a macroetched structure. See Sulfur Prints.

Contamination . . . 1) Radioactive deposition of radioactive material in any place where it is not desired, and particularly in any place where its presence may be harmful. The harm may be in vitiating the validity of an experiment or a procedure, or in actually being a source of danger to personnel, 2) presence of small percentages of deleterious elements in an alloy adversely affecting the alloy's mechanical properties and/or casting soundness.

Continuous Annealing Furnace . . . Furnace in which castings are annealed or heat treated by passing through different zones at constant temperatures.

Continuous Desulfurization . . . A process for removing sulfur from molten ferrous alloys on a continuous basis.

Continuous Phase . . . In alloys containing more than

one phase, the phase that forms the matrix or background in which the other phase or phases are present as isolated units.

Continuous Tapping . . . A furnace or holding ladle that is made to discharge molten metal continuously during normal operation.

Contraction . . . The volume change occurring in metals (except antimony and bismuth) and alloys on solidification and cooling to room temperature.

Contraction Cracks . . . Cracks formed by restriction of the metal while contracting in the mold; may occur just after solidification (called a hot tear) or a short time after the casting has been removed from the mold.

Contraction Rule . . . See Shrinkage, Patternmaker's.

Control . . . In EDP, those parts of the computer that affect the carrying out of instructions in proper sequence, the interpretation of each instruction, and the application of the proper signals.

Controlled Area . . . A defined area in which the occupational exposure of personnel to radiation or to radioactive material is under the supervision of an individual in charge of radiation protection.

Controlled Atmosphere . . . Any gas or mixture of gases that prevents or retards oxidation and decarburization.

Controlled Cooling . . . See Cooling, Controlled.

Convection . . . The motion resulting in a fluid from the differences in density and the action of gravity. In heat transmission this meaning has been extended to include both forced and natural motion or circulation.

Converter . . . A furnace in which a gas, usually air, is blown through the molten bath or crude metal for the purpose of oxidizing impurities.

Conveyor . . . A mechanical apparatus for carrying or transporting materials from place to place. Types include apron, belt, chain, gravity, roller, monorail, overhead, pneumatic, vibrating, etc.

Conveyor Belt . . . A continuously moving belt used in an automated or semiautomated foundry to move materials from one station to another.

Conveyor, Pallet . . . A materials-handling device that holds one or more molds and transports them from the molding station through pouring to shakeout.

Conveyor, Pneumatic Tube . . . An air-tube means of moving materials from one place to another, primarily orders, light metal samples, and sand and other finely divided materials, as bentonite.

Conveyor, Roller . . . A line of conveyance in an automated or semiautomated foundry which employs a series of steel rollers for moving objects.

Conveyor Screw . . . Rotary worm-type blade used

to move materials in automated core and mold making and other continuous sand-mixing operations.

Conveyor, Slat . . . A materials-handling device built on a continuous belt of metal slats that moves granular materials and castings throughout a foundry.

Conveyor, Vibratory . . . A materials-handling device used usually with shakeout operations, to help clean sand from the castings as they are moved from one place to another in the foundry and as a feeding device to regulate materials flow. Operations with vibrational energy.

Cooler . . . The largest of three water coolers surrounding the cinder notch of a blast furnace.

Cooling, Controlled . . . A process of cooling from an elevated temperature in a predetermined manner used to avoid hardening, cracking, or internal damage, or to produce a desired microstructure. This cooling usually follows the final hot forming operation.

Cooling Curve . . . A curve showing the relationship between time and temperature during the cooling of a metal sample. Since most phase changes involve evolution or absorption of heat, there may be abrupt changes in the slope of the curve.

Cooling Fin . . . See Cracking Strip.

Cooling Stresses . . . Stresses developed by uneven contraction or external constraint of metal during cooling.

Cope . . . Upper or topmost section of a flask, mold or pattern.

Cope, False . . . Temporary cope used only in forming the parting and therefore not a part of the finished mold.

Coping Out . . . The extension of sand of the cope downward into the drag, where it takes an impression of a pattern.

Copper . . . For foundry applications, copper is meant to include all alloys containing 98% or more of copper. Used for high conductivity castings. Melting point 1083 C (1981.4 F).

Copper, Electrolytic . . . Copper produced by the electrolysis method.

Corbel . . . One or more projecting courses of brick each projecting beyond the course below.

Core . . . A preformed sand aggregate inserted in a mold to shape the interior or that part of a casting which cannot be shaped by the pattern.

Core Assembly . . . Putting together a complex core made of a number of sections.

Core-Baking Dielectric . . . Heating cores to baking temperatures by means of high-frequency dielectric equipment; particularly adapted to thermo-setting resin core binders.

Core Barrel . . . Pipe-shaped device upon which a cylindrical core is formed.

Core Binder . . . Any material used to hold the grains of core sand together.

Core, Blind . . . A core in which the core print in the mold is obscured by an overhang, other cores, etc. Also called blind set core.

Core Blow . . . A gas pocket in a casting adjacent to a cored cavity caused by entrapping gases from the core.

Core Box, Combination . . . Core box and core driers from the same pattern. One half is used as a half core box and as a core drier.

Core Branch . . . Part of a core assembly.

Core Breaker . . . A machine for crushing cores or for removing cores from castings.

Core Cavity . . . The interior form of a core box that gives shape to the core. Also, the cavity produced in a casting by use of a core.

Core Collapsibility . . . The rate of disintegration of the core at elevated temperature.

Core Compound . . . A commercial mixture used as a binder in core sand.

Core Crab . . . An iron framework embedded in a large core to stiffen it and for convenience in handling.

Core Density . . . 1) Permeability of a core or 2) weight per unit volume.

Core Driers . . . Supports used to hold cores in shape while being baked; constructed from metals or sand for conventional baking, or from plastic material for use with dielectric core-baking equipment.

Core Extruder . . . A special shell-core-making machine that produces a continuous length of cores, usually of cylindrical cross-section.

Core Filler . . . Material used in place of sand in the interiors of large cores—coke, cinder, sawdust, etc., usually added to aid collapsibility.

Core Fin . . . A casting defect, a depression in the casting caused by a fin on the core that was not removed before the core was set, or by paste that has oozed out from between the joints.

Core Float . . . A casting defect caused by core movement towards the cope surface of the mold, as a result of core buoyancy in liquid steel, resulting in a deviation from the intended wall thickness.

Core Frame . . . Frame of skeleton construction used instead of a complete core box in forming intermediate and large cores.

Core Grinder . . . Machine for grinding a taper on the end of a cylindrical core or to grind a core to a specified dimension, usually flat face.

Core Gum . . . A pitchy material used as a core binder.

Core Hardness . . . The ability of a core to resist scratching or abrasion.

Core Jig . . . A device for setting core assemblies outside of the mold and placing the whole assembly in the mold.

Core Knockout Machine . . . A mechanical device for removing cores from castings.

Core Lightener . . . A core material of any size and shape used to lighten pattern castings and match plates.

Core Maker . . . A core seat so shaped or arranged that the core will register correctly in the mold; also termed locator, indicator, register, telltale.

Core-Making Machine . . . A device to make cores.

Core Mud . . . A daubing mixture used to correct defects in cores.

Core Refractiveness . . . The ability of a core to resist breakdown when exposed to heat.

Core Rod . . . A wire or rod of steel used to reinforce and stiffen the core.

Core Sand . . . Sand for making cores to which a binding material has been added to obtain good cohesion and permeability after drying. Usually low in clays.

Core Setting . . . Placing cores in a jig or mold.

Core Setting Jig . . . A device used to help set a core into the mold.

Core Shift . . . A variation from specified dimensions of a cored section due to a change in position of the core or misalignment of cores in assembling.

Core Shooter . . . A device using low air pressure to fluidize the sand mix which is released quickly in such a way as to force it into a core box.

Core Spindle . . . A shaft on which a core barrel is rotated in making cylindrical cores.

Core Sprayer . . . A device for spraying a coating on cores.

Core Strainer (Strainer tub) . . . Baked sand or refractory disc with uniform size holes through its thickness used to control the discharge of metal from pouring basins into sprues or to regulate the flow of metal in gating systems of molds; also to prevent entrance of dross or slag into the mold cavity.

Core Stickle Template (Sweep) . . . Device of wood or metal to give shape to certain types of cores or molds.

Core Truck . . . Truck or carriage used for transporting cores.

Core Vents . . . 1) A wax product, round or oval in form, used to form the vent passage in a core. Also refers to a metal screen or slotted piece used

to form the vent passage in the core box employed in a core-blowing machine, 2) holes made in the core for escape of gas.

Core Wires or Rolls . . . See Core Rod.

Coreless Induction Furnace . . . See Induction Furnace.

Coremaker . . . A craftsman skilled in the production of cores for foundry use.

Corer, Sag . . . A decrease in the height of a core, usually accompanied by an increase in width, as a result of insufficient green strength of the sand to support its own weight.

Coreroom . . . Department of the foundry in which cores are made.

Coring . . . Variable composition due to the solidification characteristics of an alloy. Typically these compositional differences occur on a micro scale, the distances between compositional extremes being controlled by the solidification structure of the alloy.

Coring Up . . . Placement of cores, chills, and chaplets in mold halves before closing the mold.

Corner Cut . . . In EDP, a corner removed from a card to facilitate orientation.

Cornerslick (Inside and Outside Corners) . . . A molder's tool used for repairing and slicking the sand in molds. Used primarily on dry sand and loam.

Corrective Effective Temperature Chart . . . A chart on which information can be plotted resulting in an adjusted temperature reading more indicative of human comfort.

Corrosion . . . 1) Gradual chemical or electrochemical attack on a metal by atmosphere, moisture or other agents, 2) chemical attack of furnace linings by gases, slags, ashes or other fluxes occurring in various melting practices.

Corrosion Index . . . A number expressing the maximum depth in mils to which corrosion would penetrate in one year on the basis of a linear extrapolation of the penetration occurring during the lifetime of a given test or service.

Corundum . . . Native alumina, or aluminum oxide, Al_2O_3 , occurring as rhombohedral crystals and also in masses and variously colored grains. Applied specifically to nontransparent kinds used as abrasives. It is the hardest mineral except the diamond. Corundum and its artificial counterparts are abrasives especially suited to the grinding of metals.

Coslettizing . . . Producing a black, rust-resisting surface on iron and steel by boiling for some hours in water containing phosphoric acid and iron filings.

Cottrell Process . . . An electrostatic method of removing solid particles from gases.

Counting Rate Meter . . . A device which gives a

continuous indication of the average rate of ionizing events.

Couple . . . Two dissimilar conductors in electrical contact. An electromotive force is created under proper electrolytic influences or during heating.

Courses . . . Alternate layers of material in a pattern, or brickwork

Cover . . . A protective blanket laid on a melt to exclude oxidizing atmosphere and in the case of magnesium to prevent its igniting. Neutral covers simply protect metal from atmosphere; reacting covers contain an agent such as a deoxidizer.

Cover Core . . . A core set in place during the ramming of a mold to cover and complete a cavity partly formed by the withdrawal of a loose part of the pattern. Also used to form part or all of the cope surface of the mold cavity. A core placed over another core to create a flat parting line.

Cover Half . . . In die casting, the stationary half of the die.

Crab . . . See Core Crab.

Crack, Hot Tear . . . A rupture occurring in a casting at or just below the solidifying temperature by a pulling apart of the soft metal, caused by thermal contraction stresses. See also Quench Crack.

Cracking Strip . . . A fin of metal molded on the surface of a casting to prevent cracking.

Crane . . . A machine for lifting heavy weights; may be hand or power operated. Types include electric, gantry, jib, monorail, etc.

Crane, Gantry . . . A bridge carrying a traveling crane and supported by a pair of trestles running on parallel tracks.

Crane, Jib . . . A crane suspended from a jib.

Crane, Mobile . . . A crane supported on structure that rolls on wheels; may be moved manually or by its own power.

Crane, Wall Jib . . . A jib crane mounted on a wall rather than on an overhead beam.

Craze Crack (Crazing) . . . Minute crack on ceramic or refractory surface caused by thermal or mechanical shock.

Crazing (Worming) . . . A defect found in pack-hardened tools, manifested in surface markings.

Creep . . . The flow or plastic deformation of metals held for long periods of time at stresses lower than the normal yield strength. The effect is particularly important if the temperature of stressing is in the vicinity of the recrystallization temperature of the metal.

Creep Limit . . . The maximum stress that will result in creep at a rate lower than an assigned rate.

Crib . . . Network of cast iron used to support the cope when no cope flask is used.

Critical Cooling Rate . . . The minimum rate of continuous cooling just enough to prevent undesired transformations.

Critical Strain . . . In forgings and rollings, the amount of cold work below which no recrystallization will take place on annealing and above which coarse grain occurs.

Cromodizing . . . A rust-proofing process for steel.

Cronak Process . . . A method of producing a film of chromium salts on zinc surfaces to inhibit corrosion.

Croning Process (C Process, Cronizing) . . . A casting process named after its German developer Johannes Croning. It is a precision production process using a phenol formaldehyde resin binder. See Shell Molding.

Cross . . . Device used for lifting and binding large loam molds.

Cross Gate . . . See Runner.

Cross Section . . . A view of the interior of an object that is represented as being cut in two, the cut surface presenting the cross section of the object.

Crossbar . . . Wood or metal bar placed in a flask to give greater anchorage to the sand than is afforded by its four walls.

Crown . . . Furnace roof, especially when dome-shaped; highest point of an arch.

CRT . . . Cathode ray tube, used in EDP display devices.

Crucible . . . A ceramic pot or receptacle made of materials such as graphite or silicon carbide, with relatively high thermal conductivity, bonded with clay or carbon, and used in melting metals; sometimes applied to pots made of cast iron, steel, or wrought steel. The name derives from the cross (Crux) with which ancient alchemists adorned it.

Crucible Furnace . . . A furnace fired with coke, oil, gas, or electricity in which metals are melted in a refractory crucible.

Crucible Wash . . . A refractory material applied to the inside of a crucible to help protect the lining from attack by the molten metal.

Crucible Zone . . . The zone in the cupola between the bottom and the tuyere.

Crush . . . Buckling or breaking of a section of mold due to incorrect register when closing. Also, an indentation in the casting surface due to displacement of sand in the mold when the mold was closed.

Crush Strip or Bead . . . An indentation in the parting line of a pattern plate which ensures that cope and drag have good contact by producing a ridge of sand

which crushes against the other surface of the mold or core.

Crystal . . . A physically homogeneous solid in which the atoms, ions, or molecules are arranged in a three-dimensional repetitive pattern.

Crystal Analysis . . . Determination of crystal structure.

Crystal Lattice . . . The way atoms are arranged in a crystal. Spacewise, there are only 14 different lattices.

Crystalline Fracture . . . Fracture of a brittle metal, showing definite crystal faces in the fractured surface.

Crystallization . . . The formation of crystals by the atoms assuming definite positions in the crystal lattice, as when a metal solidifies.

Curing Time (No Bake) . . . That period of time needed before a sand mass reaches maximum hardness.

Cut . . . Defect in a casting resulting from erosion of the sand by metal flowing over the mold or cored surface.

Cutoff Machine, Abrasive . . . A device using a thin abrasive wheel rotating at high speed to cut off gates and risers from castings, or in similar operations.

Cutter, Gate . . . A scoop or other form for cutting gates in the mold.

Cutting Abrasion . . . Abrasion involving the action of sharp-edged abrasives.

Cutting Wheel (Elastic Slitting Wheel) . . . The plastic discs impregnated with an abrasive for cutting ceramics and metals. Used on abrasive cutoff machines.

Cyclone (Centrifugal Collector) . . . In air pollution control, a controlled descending vortex created to spiral objectionable gases and dust to the bottom of a collector cone.

Cyclonic Scrubber . . . In air pollution control, radial liquid (usually water) sprays introduced into cyclones to facilitate collection of particles.

Cyclotron . . . A device for accelerating charged particles to high energies by means of an alternating electric field between electrodes placed in a constant magnetic field.

D

D (Fordath) Process . . . Shell molding in which the shell is made by blowing sand into a box like heated structure so that a shell of controlled thickness is created.

Datum Plane . . . In layout and machining operations the reference plane from which dimensions are measured in the perpendicular direction.

Datum Points . . . In layout and machining operations the reference points on a datum plane from which dimensions are measured.

Daubing . . . Filling of cracks in molds or cores by specially prepared pastes or coatings to prevent a mechanical penetration of metal into these cracks during pouring. Also, the final plastering or coating of the cupola or ladle after shrinkage has taken place during the drying period. Clay slurry or clay wash with various coating compounds are applied.

dB . . . See Decibel.

DC (Direct Chill) Casting . . . A continuous method of making ingots or billets or extrusion by pouring the metal into a short mold. Sometimes called semi-continuous casting.

Dead Annealing . . . See Annealing.

Deadburned . . . A term applied to refractory materials obtained by calcining at a temperature high enough to form a product inert to atmospheric moisture and carbon dioxide, and less apt to contract.

Deadburned Dolomite . . . Dolomite burned at high temperature with additions of an agent, such as oxide of iron.

Deadhead . . . The useless metal projecting on a casting which corresponds to the position of a riser in the mold.

Dead Steel . . . Fully killed steel, also applied to steel which fails to respond to heat treatment.

Decant . . . 1) Pour from one vessel to another, 2) pour off molten metal without disturbing the sludge.

Decarburization . . . Loss of carbon from the surface of a ferrous alloy as a result of heating in a medium, usually oxygen, that reacts with carbon.

Decibel (dB) . . . Unit for measuring the ratio amounts of acoustical power; one-tenth of a bel.

Deep Etching . . . Macroetching; etching, for examination at a low (less than 10X) magnification, in a reagent that attacks the metal to a much greater extent than normal for microscopic examination. Gross features may be developed; i.e., abnormal grain size, segregation, cracks, or grain flow.

Deepbed Filter . . . A gas filter in air pollution control, consisting of a loosely packed mat of fibrous materials; not practical where high grain loadings are encountered.

Defect . . . A discontinuity in the product whose severity is judged unacceptable in accordance with the applicable product specification.

Deformation Test . . . An AFS test using an instrument such as the Dietert Universal Sand-Strength Testing machine (with deformation accessory) to determine the amount in inches that the sand specimen is compressed before it ruptures.

Degasser . . . A material employed for removing gases from molten metals and alloys.

Degassing . . . Usually a chemical reaction resulting from a compound added to molten metal to remove

gases from the metal. Often inert gases are used in this operation.

Degassing Flux . . . A flux for removing gas from a melt.

Degree of Ramming . . . The extent of hardness to which a sand mold is rammed.

Delay Screen (Skim Gate (Erroneously), Skim Strainer) . . . A small piece of perforated light gage tinned sheet steel, or of copper, aluminum, and/or magnesium alloys, frequently placed in the pouring basin at the top of the downsprue. It delays the flow of metal long enough to allow the basin to fill before it melts to permit only clean metal from the bottom of the basin to enter the downsprue. Delay screens are also used elsewhere in the gating system.

Dendrite . . . A crystal of branched appearance, formed during solidification of alloys, the branching habit being controlled by specific crystallographic directions.

Densitometer . . . Instrument utilizing the photoelectric principle to determine the degree of darkening of developed photographic film.

Density . . . The mass per unit volume of a substance, usually expressed in grams per cubic centimeter or in pounds per cubic foot.

Density (Photographic) . . . Logarithm of opacity of exposed and processed film. Opacity is the reciprocal of transmission; transmission is the ratio of transmitted to incident intensity. Density is used to denote the degree of darkening of photographic film.

Deoxidation . . . Removal of excess oxygen from molten metal, usually accomplished by adding materials with a high affinity for oxygen, the oxides of which are either gaseous or readily form slags.

Dephosphorization . . . Elimination of phosphorus from molten steel.

Dermatitis . . . An inflammation of the skin, which may be caused by allergy to certain casting adjuncts, as resins; particularly in the shell process.

Descaling . . . Remove the fire scale from the surface of casting.

Design Base Line . . . The noise spectrum which is the goal of any particular noise reduction program.

Designations . . . Type of metal named, as steel, malleable, nonferrous, etc.

Desulfurization . . . Removal of sulfur from the molten metal by addition of suitable compounds.

Desulfurizer . . . A material used to remove sulfur from molten metals and alloys. Also, a form of holding ladle or basin in which the molten metal and desulfurizing material are brought into contact.

Detroit Cup Test . . . A cupping test for sand, using

a steel ball as plunger, the depth of cup being shown on a dial.

DeVries Test . . . A test to give the relative hardness of deep hardening steels.

Dew Point . . . The temperature at which moist air will become saturated and condensation of water vapor will take place.

Dewaxing . . . The process of melting out the expendable wax pattern from an investment mold by the application of heat, usually at temperatures less than 250 F (121 C).

Dextrin . . . Soluble gummy carbohydrate formed by the decomposition of starch by heat, acids, or enzymes; it is used in core compounds, mold compounds, mold washes, core pastes, and other compounds requiring high dry compressive strengths.

Diameters . . . In microscopy, an indication of the amount of magnification. 1000 diameters = 1000 times original size.

Diammonium Phosphate . . . Used to fireproof clothing of foundry workers.

Diaphragm Shell Molding Machine . . . An arrangement for applying a squeeze pressure with a high-temperature silicone rubber diaphragm.

Diaspore Clay . . . A rocklike mineral consisting chiefly of diaspore (HAIO_2) bonded by fire clay substance with an alumina content higher than 63%.

Dia-Tester . . . (Wolpert Hardness Tester) . . . A hardness testing machine using the Vickers or Brinell ball indenter.

Diathermometer . . . An instrument for examining the thermal resistance or the heat conducting power of objects.

Diatomaceous Earth . . . (Infusorial Earth) . . . A hydrous form of silica which is soft, light in weight and consists mainly of microscopic shells of diatoms or other marine organisms. It is widely used for furnace insulation.

Die . . . A metal block used in forming materials by casting, molding, stamping, threading, or extruding.

Die Assembly . . . The parts of a die stamp or press that hold the die and locate it for the punches.

Die Casting . . . (Brit. Pressure Die Casting) . . . A rapid, watercooled permanent mold casting process, an outgrowth of casting printer's lead, still quite limited to nonferrous metals. There are three types: the plunger-type operated hydraulically, mechanically or by compressed air with or without a gooseneck; the direct-air injection which forces metal from a gooseneck into the die, and the Cold-Chamber Machine. All force the metal into the die with a pressure greater than that of gravity flow.

Die Coating . . . See Release Agent.

Die Insert . . . A removable liner or part of a die body or punch.

Die Sinking . . . Forming or machining a depressed pattern in a die.

Dielectric Oven (Dryer) . . . A rapid-drying high frequency electric oven used to bake cores.

Die Set . . . In stamping, the parts of the press that hold the die and locate it in proper relation to the punches.

Dietert Process . . . A patented process for the production of precision molds involving blowing a contoured core around a pattern to form half a mold.

Dietert Tester . . . A patented apparatus for the direct reading of a Brinell hardness after impression without using magnification or conversion tables.

Differential Heat Treatment . . . A heating process by which the temperature is varied within the object so that, after cooling, various parts may have different properties as desired.

Diffuser . . . X-ray equipment, a portion of the condensing and focusing system that permits even distribution of energy.

Dike . . . A patented flexible seal to prevent blow-by in core boxes.

Dimensional Tolerance Grades . . . A system of classifying the tightness of tolerances for the purpose of defining accurately the tolerances involved, and for simplifying the communication process between customer and producer regarding what is wanted, and what is possible, respectively.

Dip Coat . . . In solid and shell mold investment casting, a fine ceramic coating applied as a slurry to the pattern to produce maximum surface smoothness, followed by a cheaper conventional investment.

Dip Tank . . . A tank, preferably lined with rubber, epoxy, or other nonmetallic, into which diecastings are dipped for cooling after leaving the machine.

Dipped Joint . . . A thin joint made by dipping of the brick in a thin mortar.

Direct-Arc Furnace . . . An electric arc furnace in which the metal being melted is one of the poles.

Direct Casting . . . Teeming from the ladle into the casting mold without the use of a tundish.

Dirt Trap . . . A well employed in a gating system to entrap the first metal poured, which may contain dirt or unwanted particles. See Slag Trap.

Dirty Casting . . . A casting containing an excessive amount of nonmetallic inclusions in the body of the metal.

DIS . . . See Ductile Iron Society.

Disappearing Filament Pyrometer (Optical Pyrometer) . . . A telescope in which a hot body is viewed through an eyepiece; temperature is measured by the matching color of a calibrated lamp filament with color of hot metal.

Dispersed Shrinkage . . . Small shrinkage cavities dispersed through the casting, which are not necessarily cause for rejection.

Dispersion Hardening . . . Hardening by the formation of hard microconstituents dispersed in a softer matrix.

Disruptive Strength . . . Maximum strength of a metal when subjected to three principal tensile stresses at right angles to one another and of equal magnitude.

Dissolved Carbon . . . Carbon in solution in steel in either the liquid or solid state.

Distorted Pattern . . . A pattern untrue to the specified dimensions.

Distortion . . . See Warpage.

Distribond . . . A siliceous clay containing Bentonite used as a bond in molding sands.

Distribution, Sand Grain . . . Variation or uniformity in particle size of a sand aggregate when properly screened by U.S. Standards screens.

Disturbed Metal . . . The cold worked metal formed on a polished surface during the processes of grinding and polishing.

Divorced Pearlite (Granular Pearlite, Spheroidite, Spheroidized Cementite) . . . Pearlite in which the cementite has been spheroidized by prolonged annealing just below the A_{c1} point, or by annealing at the same temperature after cold working.

Dolomite . . . A mineral calcium-magnesium carbonate ($Ca, Mg (CO_3)_2$) used as a flux in iron melting and smelting; also as a base in refractories.

Dose . . . A quantity of radiation measured at a certain point expressed in roentgens, rems or rads.

Dose, Absorbed . . . The amount of energy imparted to matter by ionizing particles per unit mass of irradiated material at the place of interest (expressed in rads).

Dose, Exposure . . . Quantity of radiation measured in air in roentgens without backscatter at a given point.

Dose Meter, Integrating . . . Ionization chamber and measuring system designed for determining total radiation administered during an exposure. In medical radiology the chamber is usually designed to be placed on the patient's skin. A device may be included to terminate the exposure when it has reached a desired value.

Dose Rate . . . Dose per unit time.

Dosimeter . . . Instrument used to detect and measure an accumulated dosage of radiation; in common usage

it is a pencil-size ionization chamber with a built-in self-reading electrometer; used for personal monitoring. See Dosimeter, Pocket.

Dosimeter, Pocket . . . A pocket ionization chamber containing its own electrometer. An auxiliary charging device is usually necessary.

Double Annealing . . . As applied to hypoeutectoid steel, a process of heating to above the upper critical point (AC_3) and holding at that temperature until complete solution of the carbide has been achieved then cooling rapidly and reheating immediately to above A_3 and slowly cooling.

Double Impression Method . . . A way of determining approximate Brinell hardness by placing a hardened steel ball between a specimen of known hardness and the metal to be tested and pressurizing in an arbor press.

Double Skin (Bottom Splash, Ingot Shell, Plaster) . . . A defect consisting of a secondary layer of metal sometimes found on top-poured ingots.

Double Tempering . . . A retempering operation sometimes necessary for steel containing retained austenite which breaks down during cooling from the first tempering to form a new and hence untempered martensite.

Doubleburned . . . Deadburn; not to be mistaken for two firings.

Dowel . . . 1) A wooden or metal pin of various types used in the parting surface of parted patterns and core boxes, 2) in diecasting dies, metal pins to ensure correct registry of cover and ejector halves.

Downcomer . . . In air pollution control, a pipe for conducting gases down into a conditioner and subsequent cleaning.

Downgate . . . See Downsprue.

Downhand Welding . . . Welding deposited along a horizontal line and surface.

Downsprue (Sprue, Downgate) . . . The first channel, usually vertical, which the molten metal enters; so-called because it conducts metal down into the mold.

Downtime . . . Time lost from normal casting activity, due to unscheduled interruption.

Draft, Pattern . . . See Pattern Draft.

Drag . . . Lower or bottom section of a mold or pattern.

Draw . . . A term used for 1) to temper, 2) to remove pattern from mold, 3) an external contraction defect on surface of mold, 4) a form of porosity defect due to insufficient venting at the corners of castings.

Draw Peg . . . A wooden peg used for drawing patterns.

Draw Plate . . . A plate attached to a pattern to facilitate drawing of a pattern from the mold.

Draw Screw . . . A threaded rod with an eye screwed into a pattern to enable it to be drawn from the mold.

Draw Spike . . . A steel spike used to rap and draw a pattern from the sand; it is driven into the wood of the pattern, as opposed to a Draw Screw, which is threaded.

Drawback . . . Part of a mold of green sand that may be drawn back to clear overhanging portions of the patterns.

Drawing . . . Removing pattern from the mold or mold from pattern in production work. See also Temper.

Dried Sand . . . Sand which has been dried by mechanical dryer prior to use in core making.

Drier (Dryer) . . . A material, as alcohol ammonium nitrate, sodium perborate and manganese oleate, added to a core or mold mixture to remove or reduce the water content.

Drillings, Test . . . Chips, or small particles of metal removed from a test specimen for chemical analysis.

Drop (Dropout) . . . A casting defect caused by sand dropping from the cope or other overhanging section.

Drop Ball . . . A heavy weight, usually ball or pear shaped, dropped from a height to break large pieces of metal scrap. Also used to strengthen warp castings.

Drop Gate . . . A term for a pouring gate or runner leading directly into the top of the mold.

Drop Off or Drop Out . . . Sand falling from the Cope of a mold. See Drop.

Drum Ladle . . . A cylindrical refractory-lined ladle that is completely enclosed. A removable cover at the pouring spout permits addition of molten metal.

Drum, Magnetic . . . An electrically energized pulley or drum used for removing magnetic materials from sand, nonferrous borings and turnings, etc.

Dry Analysis . . . A term applied to spectrographic analysis.

Dry and Baked Compression Test . . . An AFS test to determine the maximum compressive stress that a baked sand mixture is capable of developing.

Dry Pan . . . A grinding machine of heavy rollers or millers resting on a bed. Screens or slits allow fine material to pass through.

Dry Permeability . . . The property of a molded mass of sand bonded or unbonded, dried at 220–230 F (105–110 C) and cooled to room temperature that allows passage of gases resulting during pouring of molten metal into a mold.

Dry Sand Casting . . . The process in which the sand molds are dried at above 212 F (100 C) before using.

Dry Sand Core . . . See Core.

Dry Sand Mold . . . A mold from which the moisture

has been removed by heating.

Dry Strength, or Dry Bond Strength . . . The maximum compressive, shear, tensile, or transverse strength of a sand mixture which has been dried at 220 to 230 F (105 to 110 C) and cooled to room temperature.

Dryer, Core . . . See Core Driers.

Dryer, Dielectric . . . See Dielectric Oven.

Dual Metal Centrifugal Casting . . . Centrifugal castings produced by pouring a different metal into the rotating mold after the first metal poured has solidified.

Dust . . . Small solid particles created by the breaking up of larger particles by any process.

Ductile Iron . . . See Nodular Iron.

Ductile Iron Society . . . 615 Sherwood Parkway, Mountainside, NJ 07092.

E

EDP . . . Electronic Data Processing.

Elastic Limit . . . Maximum stress that a material will withstand without permanent deformation. See Yield Strength.

Elasticity . . . The property of recovering original shape and dimensions upon removal of a deforming force.

Electrical Precipitator . . . In air pollution control, the use of electrodes in stack emissions emitting high voltage; particles 0.1 micron and smaller can be attached and collected at discharge electrode.

Electrochemical Corrosion (Contact Corrosion, Electrolytic Corrosion, Galvanic Corrosion) . . . Localized corrosion from exposure of an assembly of dissimilar metals in contact or coupled with one another, i.e., electrochemical action.

Electrode . . . Compressed graphite or carbon cylinder or rod used to conduct electric current in electric arc furnaces, arc lamps, carbon arc welding, etc.

Electron Microprobe Analyzer . . . An instrument for selective analysis of a microscopic area, in which an electron beam bombards the point of interest in Vacuo at a given energy level. Intensity of backscatter is measured to interpret which chemical elements are present and by scanning a large area the microprobe can analyze chemical composition and indicate the distribution of an element.

Elongation . . . Amount of permanent extension in the vicinity of the fractures in the tensile test; usually expressed as a percentage of original gage length, such as 25 percent in 2 in. (51 mm).

Embrittlement . . . Loss of ductility. See Acid Embrittlement, Hydrogen Embrittlement.

Endothermic Reaction . . . Designating, or pertaining to a reaction which occurs with absorption of heat from the surroundings; as an endothermic substance.

Equilibrium . . . A dynamic condition of balance between atomic movements, where the resultant is zero and the condition appears to be one of rest rather than change.

Erosion . . . Abrasion of metal or other material by liquid or gas, usually accelerated by pressure of solid particles of matter in suspension, and sometimes by corrosion.

Etchant . . . A solution for chemical etching the polished surface of a metal specimen to reveal macro- or micro-structures when viewed under microscope.

Exothermic . . . Formed by or characterized by heat reaction, as in oxidation.

Exothermic Reaction . . . Chemical reactions involving the liberation of heat; such as burning of fuel, deoxidizing of iron with aluminum, and a characteristic of many feeder or riser compounds. See Endothermic Reaction.

Extensometer . . . An instrument used in the testing of metals to measure small increments of deformation.

F

Facing Sand . . . Specially prepared molding sand mixture used in the mold adjacent to the pattern to produce a smooth casting surface.

Fatigue . . . The loss of load-bearing ability of a material under repeated load application, as opposed to a single load.

Fatigue Crack or Failure . . . A fracture starting from a nucleus where there is an abnormal concentration of cyclic stress and propagating through the metal. The fracture surface is smooth and frequently shows concentric (sea shell) markings with a nucleus as a center.

Fatigue Limit . . . Maximum stress that a material will withstand without failure for an infinite number of load applications or cycles. For most steels the endurance limit is considered the fatigue strength determined for 10^7 cycles.

Fatigue Strength . . . Maximum stress that a material will withstand without failure for a specified number of load applications or cycles.

Feeding . . . The process of supplying molten metal in a mold to compensate for volume shrinkage while the casting is solidifying; the continuous supply of molten metal, as from a riser, to the solidifying metal in the casting; keeping risers open by manipulation of feeding rods.

FEF . . . Foundry Educational Foundation, 1138 Terminal Tower, Cleveland, OH 44113.

Ferrite . . . The body-centered-cubic phase of iron and steel.

Ferritic Steels . . . Steels in which ferrite is the

predominant phase. These steels are magnetic.

Fettle . . . British term meaning the process of removing all runners and risers and cleaning off adhering sand from the casting. Also refers to the removal of slag from the inside of the cupola and in Britain to repair the bed of an open hearth.

Fillet . . . A concave corner piece used on foundry patterns, a radiused joint replacing sharp inside corners.

Finish Mark . . . A symbol (f, f1, f2, etc.) appearing on the line of a drawing that represents the edge of the surface of the casting to be machined or otherwise finished.

Flame Hardening . . . A surface hardening process involving localized flame heating to above the austenite transformation temperature, A_{c_3} , followed by quenching.

Flash . . . A thin section of metal formed at the mold, core, or die joint or parting in a casting due to the cope and drag not matching completely or where core and coreprint do not match.

Flask Bar . . . A reinforcing member attached within either half of a flask to help hold the rammed sand in position.

Flask Clamp . . . A device for binding together the parts of a flask.

Flat Back . . . A pattern with a flat surface at the joint of the mold. It lies wholly within the drag and the joint of the cope is a plane surface.

Flow-Off (Pop-Off) . . . A large vent, usually located at the high point of the mold cavity. In addition to letting air and mold gases escape as metal fills the mold cavity, the flow-off fills with metal and acts to relieve the surge of pressure near the end of the pouring.

Frictional Wear . . . The displacement and/or detachment of metallic particles from a surface as a consequence of being in contact with another moving component.

G

Gage Marks . . . Reference marks; in tensile testing, the marks which indicate the gage length, used in determination of tensile elongation.

Gaging . . . Checking dimensional requirements by means of a gage.

Gouging Abrasion . . . Abrasion involving gross surface indentation and possible removal of sizable metal fragments.

Grain Fineness Number . . . A system developed by AFS for rapidly expressing the average grain size of a given sand. It approximates the number of meshes per inch of that sieve that would just pass the sample if its grains were of uniform size. It is approximately

proportional to the surface area per unit of weight of sand, exclusive of clay.

Granular Fracture (Crystalline Fracture) . . . A type of irregular surface produced when metal is broken.

Green Sand . . . A naturally bonded sand or a compounded molding sand mixture which has been tempered with water for use while still in the damp or wet condition.

Green Sand Core . . . A sand core used in the unbaked condition, also a core made from green sand and used as rammed.

H

Hardenability . . . In a ferrous alloy, the property that determines the depth and distribution of hardness induced by quenching.

Hardness . . . Resistance of a material to indentation as measured by such methods as Brinell, Rockwell, and Vickers. The term hardness also refers to stiffness of a material, or its resistance to scratching, abrasion, or cutting.

Head Metal . . . The reservoir of metal in the feeder or riser of a mold.

Heat . . . A stated tonnage of metal obtained from a period of continuous melting in a cupola or furnace, or the melting period required to handle this tonnage.

Heat Treatment . . . A combination of heating and cooling operations, timed and applied to a metal in the solid state in a way that will produce desired properties.

High Pressure Mold . . . A strong high-density mold, made by air, hydraulic, or other squeeze process.

High Stress Grinding Abrasion . . . Abrasion that occurs when the abrasive is crushed between two opposing metal surfaces.

Hindered Contraction . . . Casting contraction during solidification and cooling which is hindered by mold or core restraints.

Hollow Drill Testing (Trepanning) . . . Removing a cylindrical sample from a metal section or structure to determine soundness of the section.

Homogenizing . . . A process of heat treatment at high temperature intended to eliminate or decrease chemical segregation by diffusion.

Horizontal Axis Casting Machine . . . A centrifugal casting machine in which the axis of rotation of the mold is horizontal.

Hot Box Process . . . A furan resin-based process similar to shell coremaking; cores produced with it are solid unless mandrelled out.

Hot Strength (Sand) . . . Tenacity (compressive, shear or transverse) of a sand mixture determined at any temperature above room temperature.

Hydrogen Embrittlement . . . A condition of low

ductility resulting from the absorption of hydrogen.

Hypereutectoid Steel . . . A steel containing more than the eutectoid percentage of carbon (0.83%).

Hypoeutectoid Steel . . . A steel containing less than the eutectoid percentage of carbon (0.83%).

Hysteresis (Cooling Lag) . . . Difference between the critical points on heating and cooling due to tendency of physical changes to lag behind temperature changes.

I

ICI . . . See Investment Casting Institute.

ICS . . . Iron Castings Society, 20611 Center Ridge Road, Rocky River, OH 44116.

ID Grinding . . . Term for internal (dimension) grinding.

Ideal Critical Diameter, D_1 . . . The largest diameter of a bar which, upon quenching in an ideal quench, will exhibit 50% martensite at the center of the bar.

Ideal Quench . . . A quench in which the temperature of an object being quenched instantaneously drops to that of the quench bath and remains constant.

Illinois Inclusion Count Method . . . A determination of the index number of cleanliness of steel.

Illite . . . A mineral, typically $KAl_3Si_3O_{10}(OH)_2$, found in many clays, large workings of which are found in Illinois and Michigan.

IM & AWI . . . See International Molders & Allied Workers Union.

Impact Strength . . . The resistance a material is capable of developing against impact blows; usually expressed as the foot pounds of energy necessary to break a standard specimen. See Charpy Test.

Impact Value . . . Total energy needed to break a standard specimen by a single blow under standard conditions; e.g., Charpy Impact Test.

Impoverishment . . . Loss of any constituent from an alloy or from localized areas of an alloy by oxidation, liquation, volatilization, or changes in the solid state. The term depletion is also used, particularly in referring to the lowering of the concentration of solute in a solid solution, around particles precipitated from solid solution.

Impregnation . . . The treatment of castings with a sealing medium to stop pressure leaks, such as soaking under pressure with or without prior evacuation and either with hot or cold application. Mediums used include silicate of soda, drying oils with or without styrenes, plastics, and proprietary compounds.

Impurity . . . Any element unintentionally allowed in a metal or alloy. Some impurities have little effect on properties; others will grossly damage the alloy.

Inconel . . . An oxidation-resistant alloy, 80% Ni, 14% Cr, and 6% Fe.

Indentation Hardness . . . The resistance of a material to indentation. This is the usual type of hardness test, in which a pointed or rounded indenter is pressed into a surface under a substantially static load. See Brinell Hardness and Hardness.

Indirect-Arc Furnace . . . An electric-arc furnace in which the metal is not one of the poles of the arc.

Induction Furnace . . . A melting furnace which utilizes the heat of electrical induction.

Induction Hardening . . . A surface hardening process involving the localized use of pulsating magnetic currents to achieve heating above the austenite transformation temperature, A_{c3} , followed by quenching.

Induction Heating . . . Process of heating by electrical induction.

Inert Gas . . . A gas that will not support combustion or sustain any chemical reaction; e.g., argon or helium.

Information System . . . In EDP and automated foundry operation, a feedback system in which quality information concerning the entire operation is automatically gathered, analyzed, and disseminated. It should report all facts as soon as they occur relating to castings in order to improve the casting processes, and to assist sales, inventory, and production.

Infrared Radiation Pyrometer . . . This instrument uses the fact that the ratio of the radiated energy in two wavelength bands received from a hot body is a measure of the body's surface temperature. Temperatures down to 200 C (392 F) may be measured.

Infrared Rays . . . Pertaining to or designating those rays which lie just beyond the red end of the visible spectrum, such as are emitted by a hot non-incandescent body. They are invisible and nonactinic and are detected by their thermal effect. Their wave lengths are longer than those of visible light and shorter than those of radio waves. Can be applied in the foundry for drying or core baking operations and for heating dies. Infrared radiation and radiant heat are synonymous.

Infrared Dryer . . . A core or mold dryer employing infrared lamps.

Infusorial Earth (Diatomite, Fossil Flour, Mountain Meal, Mountain Flour, Tripolite, Kieseluhr) . . . A very fine whitish powder composed of the siliceous skeletons of infusorians (Protozoa).

Ingates . . . The channels through which molten metal enters the mold cavity.

Ingot . . . A mass of metal cast to a convenient size and shape for remelting or hot working.

Ingot Iron . . . Iron of comparatively high purity produced in open-hearth furnace under conditions that

keep down the carbon, manganese, and silicon content; e.g., Armco Iron.

Injection Molding . . . The injection of molten metal or other material under pressure into molds.

Inoculant . . . Material which when added to molten metal modifies the structure, and thereby changes the physical and mechanical properties to a degree not explained on the basis of the change in composition resulting from its use.

Inoculation . . . Addition to molten metal of substances designed to form nuclei for crystallization. See also Inoculant.

Input . . . In EDP, information transferred into internal computer storage.

Institute of Scrap Iron & Steel, Inc. . . . 1627 K St., N.W., Washington, DC 20006.

Instruction . . . In EDP, a set of characters defining an operation, with or without addresses, which cause the computer to operate according to pre-arranged programs.

Insulating Pads and Sleeves . . . As opposed to chills, insulating material, such as gypsum, diatomaceous earth, etc., used to lower the rate of solidification. As sleeves on open risers, they are used to keep the metal liquid, thus increasing the feeding efficiency.

Integral Dose (Volume Dose) . . . A measure of the total energy absorbed by man or any object during exposure to radiation.

Intensity (Radiology) . . . Amount of energy per unit time passing through a unit area perpendicular to the line of propagation at the point in question. Often this term is used incorrectly in the sense of dose rate.

Intercast Process . . . A patented procedure for die casting "cast-assembled" units with moving parts.

Intercrystalline Failure . . . Cracks or fractures that follow along the grain boundaries in the microstructure of metals and alloys.

Interdendritic Attack . . . A type of electrochemical corrosion that sometimes occurs in as-cast alloys or alloys that have had very little working.

Intergranular Corrosion . . . Corrosion in a metal taking place preferentially along the grain boundaries.

Internal Friction . . . Ability of a metal to transform vibratory energy into heat; generally refers to low stress levels of vibration; damping has a broader connotation since it may refer to stresses approaching or exceeding the yield strength.

Internal Shrinkage . . . A void or network of voids within a casting caused by inadequate feeding of that section during solidification.

Internal Stresses . . . A system of balanced forces existing within a part when not subjected to a working load. These stresses are frequently caused by contrac-

tion of a casting as it cools.

International Molders & Allied Workers Union of America . . . 1225 East McMillan Street, Cincinnati, OH.

Interrupted Quench . . . Removing the casting from a quenching bath before it has reached the temperature of the bath.

Invar . . . An alloy having practically no expansion when heated; 36% Ni, 0.5% Mn, 0.2% C, and the balance Fe.

Inverse Segregation . . . A concentration of certain alloy constituents that have lower melting points in the region corresponding to that first solidifying; caused by interdendritic flow of enriched liquid through channels where the pressure drops with contraction of dendrites. The internal evolution of hydrogen may also give a positive pressure, aiding this flow and causing a liquated surface as tin sweat. See also Segregation.

Inversion . . . A change in crystal form without change in chemical composition, as from quartz to cristobalite.

Inversion Casting . . . 1) The metal is fed through a bottom feeder, the mold being inverted for pouring, 2) the mold is directly attached to the electric furnace in which the metal is melted in a reducing atmosphere so no slag is formed. On inverting the furnace the metal runs into the mold. There are no heavy feeders and oxidation is prevented.

Investing . . . The process of pouring the investment slurry into the flask surrounding the pattern to form the mold.

Investment . . . A flowable mixture of a graded refractory filler, a binder and a liquid vehicle which when poured around the patterns conforms to their shape and subsequently sets hard to form the investment mold.

Investment Casting . . . Casting produced in a mold obtained by investing (surrounding) an expendable pattern with a refractory. The expendable pattern may consist of wax, plastic, or other material and is removed prior to filling the mold with liquid metal.

Investment Casting Institute . . . 8521 Clover Meadow Drive, Dallas, TX 75243.

Investment Precoat . . . An extremely fine investment coating applied as a thin slurry directly to the surface of the pattern to reproduce maximum surface smoothness. The coating is surrounded by a coarser, cheaper, and more permeable investment to form the mold. See Dip Coat.

Inwall Brick . . . Refractory lining of the inwall section of blast furnace or cupola.

Ionization . . . The process or the result of any process by which a neutral atom or molecule acquires either a positive or a negative charge.

Ionization Chamber . . . An instrument designed to measure quantity of ionizing radiation in terms of the charge of electricity associated with ions produced within a defined volume.

Iridium . . . A noble metal of the platinum group.

Iron . . . 1) A metallic element, mp 1535 C (2795 F), 2) irons not falling into the steel categories, as Gray Iron, Ductile Iron, Malleable Iron, White Iron, Ingot, and Wrought Iron.

Iron Carbide . . . See Cementite.

Iron, Hard or White . . . Irons (Fe_3C) possessing white fractures because all or substantially all of the carbon is in the combined form. Irons to be malleablized are cast white, as are many abrasion-resistant irons.

Iron-Iron Carbide Diagram . . . A diagram plotting temperatures vertically and carbon contents horizontally representing metastable equilibrium conditions between Fe and Fe_3C over the entire range of carbon steels and cast irons.

Iron-Carbon (Graphite) Diagram . . . A diagram plotting temperatures vertically and carbon content horizontally, representing stable equilibrium conditions between iron and graphite (pure carbon) phase over the entire range of iron and steel.

Iron, Malleable . . . A mixture of iron and carbon, including smaller amounts of silicon, manganese, phosphorus, and sulfur, which after being cast (white iron, carbon in combined form as carbides) is converted structurally by heat treatment into a matrix of ferrite containing nodules of temper carbon (graphite).

Iron Oxide . . . This material as prepared for foundry use generally contains about 85% ferric oxide and is produced by pulverizing a high grade of pure iron ore. It can be added to core sand mixes to assist in keeping the core from cracking before the metal solidifies during the casting operation and also helps to resist metal penetration during this period. It is also added to molding sand mixtures for control of finning and veining.

Iron, Pearlitic Malleable . . . A malleable iron having a more or less pearlitic matrix.

Iron Sand . . . See Iserine.

Iserine . . . A black sand which consists mainly of magnetic iron ore but also contains a considerable amount of titanium.

ISO . . . International Standards Organization.

Isocure . . . Proprietary name for a binder system developed for use in Ashland (Cold Box) Process, itself a proprietary process.

Isocyanate Acid . . . Isomeric cyanic acid ($HNCO$).

Isomorphous . . . Phases with crystal structures of the same type.

Isothermal . . . Pertaining to changes or other phenomena occurring at a constant temperature.

Isothermal Annealing . . . A process in which a ferrous alloy is heated to produce a structure partly or wholly austenitic, and is then cooled to and held at a temperature that causes transformation of the Austenite to a relatively soft ferrite-carbide aggregate.

Isothermal Transformation . . . 1) The process of transforming Austenite in a ferrous alloy to Ferrite or a ferrite-carbide aggregate at any constant temperature within the transformation range, 2) transformation of one phase in an alloy system to another phase at any constant temperature.

Isotope . . . One of several different nuclides having the same number of protons in their nuclei, and hence having the same atomic number, but differing in the number of neutrons and therefore in the mass number.

J

J . . . Symbol for 1) gram equivalent weight, 2) the mechanical equivalent of heat.

Jack Arch . . . A spring arch, flat or horizontal on the underside.

Jamb . . . Usually an upright structural member forming the side of an opening in a refractory or furnace wall.

Jamb Brick . . . A brick modified so one corner is rounded.

Jar Ramming . . . Packing sand in a mold by raising and dropping on a table the sand, pattern, and flask. Jolt squeezers, jarring machines, and jolt rammers are machines using this principle.

Jersey Fireclay Brick . . . Highly siliceous clay brick, semisilica brick.

Jet Scrubber . . . In air pollution control, a high velocity water jet directed into the throat of a venturi section of a cupola to separate out particulates.

Jet Tapping . . . A method of tapping a melting furnace by firing a small explosive charge instead of using an oxygen lance. The tapper consists of an explosive charge enclosed in a plastic case surrounded by a hollow bullet-shaped body.

Jib . . . Projecting part of crane from which lifting chain or gear is suspended.

Jig . . . Any device so arranged that it will expedite a hand or a machine operation.

Jobbing Foundry . . . A foundry engaged in the manufacture of numerous types of castings not intended for use in its own product. Usually refers to a foundry making castings for many other companies.

Jolt Ramming . . . See Jar Ramming.

Jolt-Squeezer Machine . . . A combination machine that employs a jolt action followed by a squeezing action to compact the sand around the pattern.

K

K Factor . . . Tensile strength in pounds per square inch divided by the Brinell Hardness number.

Kahlbaum Iron . . . An iron of more than 99.975% purity, produced in Germany.

Kalling-Dommarfvet Process . . . A desulfurizing process using powdered burnt lime.

Kaolin . . . The purest form of china clay consisting of silicate of aluminum. The name is derived from a hill in China.

Kappa Carbide . . . A carbide of iron ($Fe_{23}C_6$) in which all or part of the iron may be replaced by chromium, molybdenum, and/or tungsten.

Kayser Hardness Test . . . A method for determining the true hardness of metals at high temperatures.

Kelvin Temperature Scale . . . One in which the unit of measurement equals that of the centigrade degree and according to which absolute zero is 0 degrees, equivalent to -273.16 C.

Kerf . . . The space or incision resulting from filing or cutting.

Keyhole Specimen . . . A type of notched impact test specimen which has a hole-and-slot notch shaped like a keyhole.

Kieselguhr . . . Diatomaceous earth, a finely porous material used for thermal insulation to 1100 C (2012 F).

Kiln . . . An oven or furnace for burning, calcining or drying a substance.

Kiln-Dried . . . Lumber artificially dried in a specially designed enclosure or lumber kiln.

Kiln Marks . . . Irregularities on the surface of refractories caused by deformation under load during burning.

Kilovolt (kV) . . . Unit of electrical potential equal to 1,000 volts.

Kilovolts Constant Potential . . . The potential in kilovolts of a constant voltage generator.

Kilovolts Peak . . . The crest value of the potential wave in kilovolts. When only one half of the wave is used, the crest value is to be measured on this half of the wave.

Kip . . . A term sometimes used to represent a unit load of 1,000 lbs.

Kish . . . Free graphite which separates upon slow cooling of molten hypereutectic iron.

Kissing (Touching) . . . Gating with minimum metal left at casting breakoff point, having a gate just "kiss" the surface.

Knockout Pins (Ejector Pins) . . . Small diameter pins affixed to die casting or permanent mold dies that eject the casting upon opening the die. Also affixed to pattern back-up plate for removing cured mold in the shell-molding process.

L

Ladle . . . Metal receptacle frequently lined with refractories used for transporting and pouring molten metal. Types include hand, bull, crane, bottom-pour, holding, teapot, shank, lip-pour.

Ladle, Bottom-Pour . . . Ladle from which metal, usually steel, flows through a nozzle in the bottom.

Ladle, Bull . . . A large ladle for carrying molten metal. Frequently used to designate a transfer ladle.

Ladle, Lip-Pour . . . Ladle in which the metal is poured over a lip, much as water is poured out of a bucket.

Ladle, Teapot . . . A ladle in which, by means of an external spout, metal is removed from the bottom rather than the top of the ladle.

Lance, Oxygen . . . A device, consisting of steel pipe, tubing, oxygen source, and controls which uses the heat of burning steel pipe for melting. Frequently used to open frozen tap or slag holes.

Lining . . . Inside refractory layer of firebrick, clay, sand, or other material in a furnace or ladle.

Lining, Monolithic . . . A lining made without the customary layers and joints of a brick wall. Usually made by tamping or casting refractory material into place, drying, and then burning in place on the job.

Liquid Penetrant Testing . . . A nondestructive testing method suitable for evaluating the surface integrity of non-magnetic and ferro-magnetic parts.

Logo . . . The sign, mark, or distinguishing letter designating the manufacturer.

Loose Piece . . . 1) Core box: part of the core box which remains embedded in the core and is removed after lifting off the core box. 2) Pattern: laterally projecting part of a pattern so attached that it remains in the mold until the body of the pattern is drawn. Back-draft is avoided by this means. 3) Permanent mold: part which remains on the casting and is removed after the casting is ejected from the mold.

Low Stress Scratching Abrasion . . . Abrasion involving near zero impingement angle for the striking particle, also called parallel flow erosion.

M

Machine Allowance . . . Stock added to the part to permit machining of the part to final dimensions.

Machine Drawing . . . An engineering drawing which depicts the final size and shape of the part for its end use.

Magnetic Particle Inspection . . . A nondestructive method of inspecting the surface integrity of ferromagnetic materials.

Martensite . . . A constituent found in hardened steel; displays an acicular microstructure.

Mass Effect . . . The effect that the mass of a component has on the properties of the material from which the part is made. In castings such effects may arise due to the effect of mass on the solidification and on the rate of temperature change during heat treatment.

Matchplate . . . A plate of metal or other materials on which patterns and gating systems, split along the parting line, are mounted back to back to form an integral piece.

Metallographic Structure . . . The nature, distribution, and amounts of the metallographic constituents in a metal.

Metalloid . . . 1) An element intermediate between metals and nonmetals possessing both metallic and nonmetallic properties, as arsenic, 2) sometimes applied to elements commonly bonded in small amounts in steel, as carbon, manganese, boron, silicon, sulfur, and phosphorus.

Metallstatic Pressure . . . A compound phase referring to hydrostatic pressure, substituting Metall since Hydro connotes water.

Metallurgical Bond . . . The bond between two metals whose interface is free of voids, oxide films, or discontinuities.

Metallurgy . . . The science of metals, a broad field that includes but is not limited to the study of internal structures and properties of metals and the effects on them of various processing methods, from ore refining to consumer product. Its principal branches are process metallurgy and physical metallurgy.

Metallock . . . A method of cold repair of castings and forgings.

Metals Comparator . . . An instrument for testing or identifying metallic and nonmetallic parts. Parts are placed in an electromagnetic field and a standard part in a matched electromagnetic field. Distortions of the magnetic fields are compared on an oscilloscope.

Metamic . . . A metal ceramic high in $\text{Cr-Al}_2\text{O}_3$.

Metastable (Unstable) . . . A state of pseudo-equilibrium of melted metals.

Mexico Bay Sand . . . A sand similar to Michigan City dune sand mined at Selkirk Beach, near Mexico, N.Y., on Lake Ontario. It has a silica content of 90% and over.

Meyer Hardness Test . . . A test to determine tendency

of a metal to harden when deformed plastically. A series of indentations are made in the metal using a fixed-diameter ball and progressively increasing loads.

M_s . . . The temperature at which martensite formation finishes during cooling.

Mica Schist . . . A type of micaceous refractory rock used for lining cupolas and other melting furnaces.

Mica Strainer . . . A skim core made of thin mineral silicates crystallizing in monoclinic form.

Michigan Sand . . . Core sands of dune or lake sand and bank sands found in Michigan.

Micro Pipes (Brit.) (Microshrinkage) . . . Tiny cavities, a fraction of a millimeter in diameter, with irregular outlines, which occur in castings. Etching shows they occur at intersections of convergent dendritic directions.

Microcast Process . . . A patented method of precision-casting alloys, as Vitallium, Monel, Inconel and the Haynes Stellite alloys.

Microetching . . . Etching of metal samples for examination under the microscope.

Microformer . . . A type of extensometer for measuring elongation of test piece in a tensile test.

Micrography . . . Examination by means of a microscope.

Microhardness . . . The hardness of microconstituents of a material.

Microinch . . . 0.000001 in., common unit of measurement in surface measurement research and in standard roughness (surface) unit values of performance of machinery.

Microlog . . . A test coupon used to give rapid indication of the effectiveness of magnesium treatment of ductile iron.

Microporosity . . . See Microshrinkage.

Microradiography . . . The process of passing x-rays through a thin section of an alloy in contact with a photographic emulsion, and then magnifying the radiograph 50 to 100 times to observe the distribution of alloying constituents and voids.

Microscopic . . . Minute objects or structures which are invisible or not clearly distinguished without the use of a microscope.

Microsection . . . A metal specimen whose surface has been polished and etched to reveal the microstructure.

Microshrinkage . . . Very finely divided porosity resulting from interdendritic shrinkage resolved only by use of the microscope; may be visible on radiographic films as mottling.

Microspectroscopy . . . A method of identifying metallic constituents using spectographic arc.

Microstructure . . . The structure of polished and etched metal and alloy specimens as revealed by the microscope at magnifications over 10 diameters.

Microtome (Brit.) . . . An instrument for cutting thin sections of soft specimens.

Migra Iron (Brit.) . . . A special pig iron for high quality castings.

Mikro-Tester . . . A low load hardness tester, suitable for both Vickers and Knoop tests, working with loads of between 10 to 3000 grams.

MIL STD . . . United States Government military standards, specifications, usually requiring rugged, exacting testing equal to the exigencies of combat usage.

Mild Steel . . . Plain carbon steel of about 0.25% carbon.

Mill Scale . . . Iron oxide scale formed on steel during hot working processes, cooled in air.

Mill Stars . . . Multipointed white iron or hard iron bodies used in a Tumbling Barrel to assist in polishing and cleaning.

Milling . . . Removing metal with a milling cutter.

Milliroentgen (mr) . . . A submultiple of the roentgen equal to one-thousandth (1/1000th) of a roentgen.

Milliscope (Brit.) . . . An instrument which gives an electrical warning when melt reaches a predetermined temperature.

Mineral . . . Natural inorganic substance which is either definite in chemical composition and physical characteristics or any chemical element or compound occurring naturally as a product of inorganic processes.

Mischmetal . . . An alloy of rare earth metals containing about 50% cerium with 50% lanthanum, neodymium, and similar elements.

Miscibility . . . Solubility; ability of two or more liquids to form a homogeneous solution.

Misrun . . . Denotes an irregularity of the casting surface caused by incomplete filling of the mold due to low pouring temperatures, gas back-pressure from inadequate venting of the mold, and inadequate gating.

Mitis Casting . . . Castings of very mild steel.

Mock-Up . . . A full-sized model built accurately for study, testing, or display.

Model . . . A proportional representation of an object in any scale.

Modell Number . . . A value giving a measure of wear resistance.

Modification . . . A process in which the eutectic temperature, structure, and composition of aluminum-silicon alloys are apparently altered by the addition of small amounts of a third element, such as sodium.

A similar phenomenon can be effected by chill casting.

Modulus of Elasticity . . . In tension it is the ratio of stress to the corresponding strain within the limit of elasticity of a material. For carbon and low alloy steels of any composition and treatment, the value is approximately 29,000,000 psi.

Modulus of Resilience . . . The amount of energy absorbed when one cubic inch of materials is stressed in pure compression or tension to its elastic limit. The modulus of resilience is proportional to the area under the elastic portion of the stress-strain diagram.

Modulus of Rigidity . . . In a torsion test the ratio of the unit shear stress to the displacement caused by it per unit length in the elastic range.

Mogullizer . . . Equipment for sealing by vacuum impregnation of small pores in castings.

Moh's Scale . . . A scratch hardness test for determining comparative hardness using ten standard minerals, from talc to diamond.

Moisture Content . . . Amount of water contained in a substance that can be driven off by heating at 220–230 F (104.4–110 C).

Moisture Teller . . . A patented apparatus for the rapid determination of moisture content of molding sands.

Moisture, Workable . . . That range of moisture content within which sand fills, rams, draws, and dries to a satisfactory mold, and within which the sand does not dry out too fast to mold and patch.

Molasses Water . . . A solution of water and molasses sprayed on sand molds to strengthen mold surface and yield a fine finish layer.

Mold Blower . . . A shell molding instrument for blowing sand mixture onto the pattern with compressed air; allows for faster production than gravity rollover dump.

Mold Board (Follow Board) . . . The board upon which the pattern is placed to make the mold.

Mold Cavity . . . The space in a mold which is filled with liquid metal to form the casting upon solidification. The channels through which liquid metal enters the mold cavity (sprue, runner, gates) and reservoirs for liquid metal (risers) are not considered part of the mold cavity proper.

Mold Clamps . . . Devices used to hold or lock cope and drag flask parts together.

Mold Coating (Mold Facing, Dressing) . . . 1) Coating to prevent surface defects on permanent mold castings and die castings, 2) coating on sand molds to prevent Metal Penetration and improve metal finish.

Mold Cover Half (Cover Die) . . . 1) The top half of the mold, the cope, 2) in die casting, the front half of the die, which remains stationary as the die is opened.

Mold Facing . . . See Mold Coating.

Mold Jacket . . . A wooden or metal form slipped over a mold made in a snap or slip flask to support the sides during pouring.

Mold Shift . . . A casting discontinuity resulting from misalignment of the cope and drag halves.

Moldability . . . Ability of sand to flow into a flask and around a pattern; measured in the amount of sand falling through an inclined screen or slot.

Moldability Controller . . . A patented device for controlling water additions to sand mix to maintain a consistent moldability index.

Molding, Bench . . . Making sand molds by hand tamping loose or production patterns at a bench without assistance of air or hydraulic action.

Molding, Floor . . . Making sand molds from loose or production patterns of such size that they cannot be satisfactorily handled on a bench or molding machine, the equipment being located on the floor during the entire operation of making the mold.

Molding Gravel . . . The coarser and more permeable grades of molding sand generally used in producing castings of exceptional size and weight.

Molding Material . . . A material suitable for making molds into which molten metal can be cast.

Molding, Pit . . . Molding method in which the drag is made in a pit or hole in the floor.

Molding Sand Mixture . . . A sand mixture suitable for making molds into which molten metal can be cast.

Molding Sands . . . Sands containing over 5% natural clay, usually between 8 and 20%. See also Naturally Bonded Molding Sand.

Molecular Weight . . . Weight of the smallest quantity of a substance possessing all its normal physical properties.

Molecule . . . The smallest particle of a substance that can exist in the free state and which has the same composition as any larger mass of the substance.

Molybdenum . . . A metal used widely in alloying of other metals. It is used as a hardening element for steel, to impart Red Hardness to the steel, and for diecasting dies. Melting point 2620 C (4748 F).

Molybdic Oxide . . . The oxide of molybdenum; added to the furnace in briquetted form as an important finishing constituent in nitriding steels.

Monel Metal . . . A high nickel alloy, approximately 67% Ni, 28% Cu, the balance Fe, Mn, Si and other elements. Monel metal is resistant to corrosion and is widely used to resist the action of acids.

Monitoring . . . 1) Periodic or continuous determination of the dose rate in an occupied area (area monitor-

ing) or of the dose received by a person (personnel monitoring), 2) periodic or continuous determination of the amount of ionizing radiation or radioactive contamination present in an occupied region, as a safety measure for purposes of health protection, 3) personnel—monitoring any part of any individual, his breath, or excretions, or any part of his clothing.

Monitoring, Area . . . Routine monitoring of the level of radiation or of radioactive contamination of any particular area, building, room, or equipment. Usage in some laboratories or operations distinguishes between routine monitoring and survey activities.

Monkey Cooler (Brit.) . . . In a blast furnace, the smaller of a series of three water coolers protecting the cinder notch. The largest is the cooler, while the in-between cooler is the intermediate cooler.

Monocast Process . . . A patented application of resin-bonded sand to line the flask in the production of centrifugally cast pipe. The resin-bonded layer is thinner than the conventional sand lining.

Monotectic . . . As isothermal reversible reaction in a binary system where a liquid, during cooling, forms a solid and a second liquid of different composition.

Monotron . . . An instrument for measuring indentation hardness. It is fitted with two dials, one to measure depth of penetration, the other the load.

Montmorillonite . . . A very plastic clay, more siliceous than kaolinite; the principal constituent of bentonite.

Moore, R. R., Fatigue Machine . . . A constant load rotating bending type fatigue testing machine.

Mother Metal . . . The molten alloy just before final solidification and freezing out of the solid.

Motorized Variac . . . An autotransformer for stepless voltage control in shell molding.

Mottled Cast Iron . . . Iron which consists of a mixture of variable proportions of gray cast iron and white cast iron; such a material has a mottled fracture.

MP . . . Melting point.

M_s . . . The temperature at which transformation of austenite to martensite starts during cooling.

Mud . . . A term frequently used to designate plastic lining materials. See also Daubing.

Mud Daub . . . See Daubing.

Muffle Furnace (Kiln) . . . A furnace in which the heating is indirect; the material to be heated is contained in a refractory container heated from the outside.

Muller . . . A type of foundry sand-mixing machine.

Mulling and Tempering . . . The thorough mixing of sand with a binder, either natural or added, with lubricant or other fluid, as water.

Muliductor Power Source . . . A device to convert standard 3-phase, 60-cycle current to single-phase, 180-cycle current, so-called medium frequency; produces a strong, controlled stirring action for induction melting.

Multiple Mold . . . A composite mold made up of stacked sections, each of which produces a complete gate of castings, and poured from a central downgate.

Mushet Steel . . . An air hardened steel containing about 2% C, 2% Mn, and 7% W, developed by Scotsman Robert Mushet in 1870.

Mushy Stage . . . The state between solid and liquid in alloys which freeze over a wide range of temperatures.

N

NACE . . . National Association of Corrosion Engineers, PO 986, Katy, TX 77450.

National Bureau of Standards . . . Gaithersburg, MD 20760.

National Foundry Association . . . P.O. Box 128, Westchester, IL 60153.

National Industrial Sand Association . . . 900 Spring St., Silver Spring, MD 20910.

National Machine Tool Builders Association . . . 7901 Westpark Drive, McLean, VA 22101.

National Safety Council . . . 444 N. Michigan Avenue, Chicago, IL 60611.

Natural Aging . . . See Aging.

Natural Sand . . . Unconsolidated sand, sand derived from a rock in which grains separate along their natural boundaries. This includes soft sandstone where little pressure is required to separate the individual grains.

Naturally Bonded Molding Sand . . . A sand containing sufficient bonding material as mined to be suitable for molding purposes.

Navy (USA) Tear Test . . . A method of evaluating the susceptibility of ship plate to brittle or cleavage-type fracture.

NBS . . . See National Bureau of Standards.

NDDT . . . Nil ductility transition temperature, determined in the dropweight test.

Neat Brick . . . Brick with faces arranged so one of the flat faces is inclined toward the other, almost eliminating one end face.

Neat Cement . . . Portland cement mixed with water only.

Neck Down (Knock-Off, Wafer Core, Washburn, Cameron Core) . . . A thin core or tile used to restrict the riser neck, making it easier to break or cut off the riser from the casting. See Core.

Necking . . . Reducing the cross sectional area of metal in an area by stretching.

Necking Down . . . Reduction in area concentrated at the subsequent location of fracture when a ductile metal is stressed beyond its yield point in tension.

Needles . . . Elongated acicular crystals, tapering at each end to a fine point, as martensite.

Needling Agents . . . Special agents such as boron which markedly increase the hardenability of steel.

Negative Quenching (Negative Hardening) . . . Accelerated cooling in water or oil, from a temperature below the critical range.

Negative Thermodie Heat Exchange . . . In shell molding, improving the mass-surface ratio by simulating profile geometry of pattern or core cavity on the underside; will boost running temperature of high projections by 25 percent.

Nesh (Hot Short) . . . A British term applied to metal that is weak and ruptures easily under hot working conditions.

Network Structure . . . A structure in which the grains or crystals of one constituent are partly or entirely enveloped in another constituent; an etched section through the crystals resembles a network.

Neumann Band . . . A mechanical twin in ferrite.

Neutral Refractories . . . A loose term designating refractories which presumably will not react with so-called acid or basic refractories and slags.

Neutron . . . Elementary nuclear particle with a mass (1.00893 mass units) approximately the same as that of a hydrogen atom. It is electrically neutral.

New Jersey Sand . . . A large number of grades of foundry sands mined in southern New Jersey.

NFFS . . . See Non-Ferrous Founders' Society.

Nichrome . . . Oxidation-resistant alloy 65% Ni, 20% Fe, and 15% Cr.

Nickel . . . Element used for alloying iron and steel as well as nonferrous metals; melting point 1455 C (2651 F). Nickel is also a base metal for many casting alloys resistant to corrosion and high temperature oxidation. See Monel, Nimonic, Inconel, Ni-Hard.

Ni-Hard . . . Hard white cast iron containing 4% Ni and 2% Cr.

Nimonic . . . Class of nickel-base cast alloys resistant to stress and to oxidation at high temperatures. See Inconel.

Nine-Inch Equivalent . . . Standard unit of volume in refractories industries; $9 \times 4\text{-}1/2 \times 2\text{-}1/2\text{-in.}$ brick.

Nipple . . . A pipe coupling consisting of a short piece of threaded tubing.

Nital . . . A solution of nitric acid in alcohol used as an etching agent in ferrous metallography.

Nitriding . . . A surface hardening process involving heating in an atmosphere of ammonia or in contact with a nitrogen-bearing material so as to promote the absorption of nitrogen.

Nitrogen Flush . . . Bubbling nitrogen gas through a metal melt under vacuum (as with valve bronze) to improve tensile properties and pressure tightness.

Nobake Binder . . . A synthetic liquid resin sand binder that hardens completely at room temperature, generally not requiring baking, used in Cold-Setting process.

Noble Metals . . . Metallic elements with surfaces that do not readily oxidize in air; e.g., gold, silver, platinum.

Nodular Fireclay (Burley, Burley Flint) . . . Rock containing aluminous or ferrogenous nodules, or both, bonded by fireclay.

Nodular Graphite . . . Graphite or carbon in nodular form, characteristically in malleable and nodular iron.

Nodular Iron . . . Iron of a normally gray cast iron type that has been suitably treated with a nodularizing agent so that all or the major portion of its graphitic carbon has a nodular or spherulitic form as cast. Often referred to as Ductile Iron.

Noise Radiator . . . A device creating noise.

Noise Spectrum . . . The various frequencies making a noise.

Nomogram (Graph) . . . A graph that enables one by the aid of a straight-edge to read off the value of a dependent variable when the value of two or more independent variables are given.

Nondestructive Testing (Inspection) . . . Testing or inspection that does not destroy the object being tested or inspected.

Nonferrous . . . A negative term, refers to alloy in which the predominant metal or solvent is not iron.

Non-Ferrous Founders' Society . . . 221 North LaSalle Street, Chicago, IL 60601.

Normal Segregation . . . Concentration of alloying constituents that have low melting points in those portions of a casting that solidify last. Compare with Inverse Segregation.

Normal Steel . . . Steel in which the pearlite is completely laminated.

Normalizing . . . Heating a ferrous alloy to a suitable temperature above the transformation temperature A_{c3} , followed by cooling at a suitable rate, usually in still air to a temperature substantially below the transformation range.

Notch Bar . . . Small size ingot with notches to facilitate breakage for remelting.

Notched Bar . . . A test specimen which is notched. Used in impact or fatigue tests.

Novalak . . . A two-step basic flake resin with no

thermosetting properties, applied to sand in shell molding process as a solid or solution.

Nowel . . . A colloquial term for the drag portion of a mold; the term drag is preferred. See Drag.

Nozzle . . . Pouring spout of the bottom-pour ladle.

Nozzle Brick . . . A thick-walled tubular refractory shape set in bottom of a ladle through which steel is teemed.

Nozzle Pocket Brick . . . A refractory shape set in bottom of a ladle containing a recess in which nozzle is set.

NTP . . . Normal temperature and pressure reference point; zero centigrade 760 mm mercury pressure.

Nucleation . . . 1) (self-nucleation, homogeneous) the initiation of solid crystals from the liquid stage, or a new phase within a solid without outside interference, 2) (heterogeneous) foreign particles altering the liquid-solid interface energy during phase changes.

Nucleus . . . The first structurally determinate particle of a new phase or structure that may be about to form. Applicable in particular to solidification, recrystallization, and transformations in the solid state.

O

Oddsides . . . Semipermanent molds of plaster of paris, graphite, or dry sand, tarred and dried and used for repetitive work in the foundry.

Off-Dimension . . . A casting defect caused by any incorrect dimension resulting from improper setting of cores, using wrong core, shifts, swells, etc.

Off-Gage (Off-Size) . . . Core defect caused by improper gaging of dimensions.

Off-Grade Metal . . . Metal whose composition does not correspond to the designated or applicable specification.

Off Iron . . . Pig iron not of the desired composition.

Oil and Whiting Test . . . A method of detecting fine cracks by applying a penetrating oil and painting the tested metal surface with a mixture of whiting and a thinner. Oil in the cracks emerges to stain the whiting.

Oil Core or Mold . . . A core or mold in which the sand is bonded by an oil binder.

Oil-Oxygen Binder (Cold-Setting, Air-Setting Binders) . . . A synthetic auto-oxidizing liquid, oil-based binder that partially hardens at room temperature, using an oxygen releasing agent. Baking is needed to complete the hardening.

Oil Quenching . . . Quenching in oil, see Quenching.

Oil Sands . . . Sands bonded with such oils as linseed and the synthetics.

Oil Shot . . . In die casting, a spongelike whirl on

the surface of casting resulting from an excess of oil applied to the sprue hole before the shot was made.

Olivine . . . ($Mg_2Fe_2SiO_4$) A naturally occurring mineral composed of fosterite and fayalite, crushed and used as a molding sand.

One-Piece Pattern . . . Solid pattern, not necessarily made from one piece of material. May have one or more loose pieces.

One-Screen . . . A distribution of a clean sand or a sand with two maximum screens separated by a minimum screen. These high-expansion problem sands are also referred to as camel back distributions.

Online . . . In EDP, operation of any input/output device as a component of a computer; under computer control; tied into a computer.

Open Face Mold . . . See Open Sand Casting.

Open Flame Furnace . . . As opposed to the crucible furnace; in the open-flame furnace the metal charge is confined in the refractory lining, with the flame and products of combustion coming in direct contact with the metal.

Open Grain Structure . . . A defect wherein a casting, when machined or fractured, appears to be coarse grained and porous; usually due to a shrink area.

Openhearth Furnace . . . A furnace for melting metal, in which the bath is heated by the combustion of hot gases over the surface of the metal and by radiation from the roof.

Open Riser . . . See Riser, Open.

Open Sand Casting . . . A casting produced in an open mold; poured in the drag, with no cope or other top covering.

Optical Pyrometer . . . A temperature measuring device through which the observer sights the heated object and compares its incandescence with that of an electrically heated filament whose brightness can be regulated; or the intensity of the light admitted from the object may be varied through filters and compared with a constant light source.

Optimum Moisture . . . That moisture content which results in developing the maximum of any property of a sand mixture.

Orange Peel . . . A pebble-grained surface that develops in the mechanical forming of sheet metals with coarse grains.

Orange Peel Bucket . . . A bottom-drop bucket used for charging cupolas; the drop-bottom is divided into a number of sections that appear to peel back as the bucket opens.

Ore . . . A mineral from which a metallic element may be extracted profitably.

Orifice . . . An opening of controlled size used to measure or control the flow of gases.

Orifice Plate . . . In a cupola a device used to measure the volume of air delivered to the windbox.

Osmondite . . . An obsolete term once used to designate a ferrous microstructure not so well defined as Troosite.

Oscillating Trough Cooler . . . A steel trough conveyor within a plenum where reclaimed sand is cooled prior to reuse.

Ottawa Sand . . . A sand originating near Ottawa, Ill., also known as St. Peter sandstone.

Output . . . In EDP, information transferred from the internal storage of a computer through such output devices as printers and CRT's.

Oven, Drying . . . A furnace or oven for drying molds or cores.

Ovens . . . See Continuous Annealing Furnace.

Overaging . . . Aging a nonferrous, precipitation-hardening alloy under conditions of time and temperature greater than those required to obtain maximum strength or hardness.

Overfiring . . . Heating refractories to a temperature sufficient to cause pronounced vitrification, deformation, or bloating.

Overflows (Overflow Wells) . . . Separated cavities cut into the face of die casting dies adjacent to the main cavity and connected to it by a channel, ensuring filling of cavity.

Overhang . . . Extension of the end surface of the cope half of a core print beyond that of the drag to provide clearance for closing of the mold.

Overheated . . . A term applied when, after exposure to an excessively high temperature, a metal develops an undesirably coarse grain structure, but is not necessarily damaged permanently. Unlike burned structure, the structure produced by overheating can be corrected by suitable heat treatment, by mechanical work, or by a combination of the two.

Overstressing . . . Permanently deforming a metal by subjecting it to stresses that exceed the elastic limit.

Owens Jet Dust Counter . . . An instrument similar to the Konimeter, using the humidification factor.

Oxidation . . . Any reaction of an element with oxygen. In a narrow sense, oxidation means the taking on of oxygen by an element or compound, and on the basis of the electron theory it is a process in which an element loses electrons.

Oxidation Losses . . . Reduction in amount of metal or alloy through oxidation. Such losses usually are the largest factor in melting loss.

Oxide . . . A compound of oxygen with another element.

Oxidizing Atmosphere . . . An atmosphere resulting

from the combustion of fuels in an atmosphere where excess oxygen is present, and with no unburned fuel lost in the products of combustion.

Oxygen Bomb Calorimeter . . . An instrument to measure the heats of combustion of solid and liquid fuels.

Oxygen Impingement Process . . . Pure oxygen is blown down on the bath to refine pig iron.

Oxygen Lance . . . See Lance, Oxygen.

P

P₁ . . . In production, the acceptable quality level.

P₂ . . . In production, lot tolerance.

Pack Hardening (Pack Carburizing) . . . See Case Hardening.

Packing or Packing Material . . . Sand, gravel, mill scale, or similar materials used to support castings packed in annealing pots, to prevent possible warpage under high temperatures.

Padding . . . The process of adding metal to a cross section of a casting wall, usually extending from a riser, to ensure adequate feed to a localized area where a shrink would occur if the added metal were not present.

Panel Spalling Test . . . A test using a panel of the refractory being tested to provide a reference to spalling behavior.

Panoramic Analyzer . . . An instrument for analyzing sounds and displaying the results either on an oscilloscope or a graph.

Parkerizing . . . A proprietary method of producing a protective phosphate coating on ferrous metals. Parker A treatment involves immersing in a bath of acid manganese phosphate. The Parker D is a modification using acid zinc phosphate with a nitrate iron as accelerator.

Parlanti Casting Process . . . A proprietary permanent mold process using dies of aluminum with a controlled rate of heat transfer.

Parsons Duncan Process . . . A method of casting steel ingots wherein the top layer of the mold is heated and is the last to solidify.

Parted Pattern . . . A pattern made in two or more parts.

Partially Graphitized Cast Iron . . . A blackheart malleable casting only partly graphitized in annealing, giving a mixture of black and white. Sometimes termed salt and pepper fracture.

Particulate Matter . . . In air pollution control, solid or liquid particles, except water, visible with or without a microscope, that make up the obvious portion of smoke.

Parting Agent . . . See Release Agent.

Parting Line . . . 1) A line on a pattern or casting corresponding to the separation between the cope and drag portions of a sand mold, 2) mark left on casting at joint.

Passivator . . . An inhibitor which changes the potential of a metal to a more cathodic value.

Passivity . . . The property of some metals to become abnormally inactive towards certain reagents.

Patching . . . Repair of a furnace lining; repair of a mold core.

Pattern . . . A form of wood, plastic, metal, or other material around which molding material is placed to make a mold.

Pattern Draft . . . The taper on vertical elements in a pattern which allows easy separation of pattern from compacted sand mixture.

Pattern Layout . . . Full-sized drawing of a pattern showing its arrangement and structure features.

Patternmaker . . . A craftsman engaged in production of foundry patterns from wood, plastic, or metals, such as aluminum, brass, etc.

PCE . . . Pyrometric Cone Equivalent.

Pearlite . . . A lamellar aggregate of ferrite and carbide, the structure of pearlite can appear fine or coarse depending on processing.

Peen . . . Peening action obtained by impact of metal shot, often used to improve fatigue properties by putting the surface in compression.

Pencil Core . . . A core projecting to the center of a blind riser allowing atmospheric pressure to force out feed metal.

Penetrameter . . . A strip of metal with stepped thickness variation and with holes at varying depths; used in radiography to indicate the sensitivity of the radiograph.

Penetration, Metal . . . Condition where molten metal has penetrated into the sand resulting in a mixture of metal and sand adhering to the casting.

Periclase . . . Natural magnesia in nodular form, formed by heating.

Perlite . . . A highly siliceous volcanic rock which can be expanded by heating into a porous mass of particles. Perlite can be used as an insulation in foundry sand mixtures. Not to be confused with Pearlite.

Permanent Mold . . . A metal mold of two or more parts; not an ingot mold. It is used repeatedly for the production of many castings of the same form. Liquid metal is poured in by gravity.

pH . . . A symbol denoting the negative logarithm of the concentration of the hydrogen ion in gram-atoms per liter, used in expressing both acidity and alkalinity;

pH = log I/H per liter. An important factor in foundry sand control, pH7 is neutral; values less than 7, acid, and higher than 7, basic.

Phase Diagram . . . A graphic representation of the equilibrium temperature and composition limits of phase fields and phase reactions in an alloy system. In a binary system, temperature is usually the ordinate and composition the abscissa. Ternary and more complex systems require several two-dimensional diagrams to show the temperature—composition variables completely. In alloy systems, pressure is usually considered constant, although it may be treated as an additional variable.

Phenolic Resin (One-Step) . . . A resin made by the polymerization of a phenol with an aldehyde; used as a binder for cores and sand molds. See Urea-Formaldehyde Resin.

Photomicrograph . . . A photograph of the grain structure of a metal as observed when optically magnified more than 10 diameters. The term micrograph may be used.

Physical Metallurgy . . . The science concerned with the physical and mechanical characteristics of metals and alloys.

Physical Properties . . . For definitions of specific physical properties refer to Chapters 24, 25, and 26.

Picral . . . An etchant for ferrous alloys; 4% picric acid in alcohol.

Pig Iron, Basic . . . A grade of pig iron made for the basic openhearth process of steelmaking: P, 0.40% max for Northern iron, 0.70 to 0.90% for Southern iron; S, 0.05% max and Si, 1.50% max.

Pig Iron, Chateaugay . . . Pig iron from Chateaugay (New York State) ores very low in phosphorus; copper-free and containing appreciable amounts of titanium.

Pilot Casting . . . Casting produced prior to the production run to verify correctness of procedures, materials, and process to be used in production.

Pipe . . . A cavity formed by shrinkage of the metal during solidification, usually occurring in a riser having feeder metal for the casting.

Plaster of Paris . . . A semihydrated form of calcium sulfate made by sintering gypsum to 120–130 C (248–266 F).

Plastic Deformation . . . Permanent distortion of a material under the action of applied pressure.

Plates, Core Drying . . . Flat plates of metal on which cores are placed for baking.

Pohlman Method . . . A technique for the ultrasonic testing of steel in which a visible image of the defects present in the steel can be shown on a screen.

Postheating . . . A process used immediately after welding whereby heat is applied to the weld zone either for tempering or for providing a controlled rate of cooling, in order to avoid a hard or brittle structure.

Pouring . . . Transfer of molten metal from furnace to ladle, ladle to ladle, or ladle into molds.

Pouring Cup . . . The flared section of the top of the downsprue. It can be shaped by hand in the cope, or be a shaped part of the pattern used to form the downsprue; or may be a baked core cup placed on top of the cope over the downsprue.

Powder Cutting . . . Introducing iron powder in an oxygen stream to hasten oxygen torch cutting by the combination of fluxing and oxidation.

Precipitation Hardening . . . A process for hardening an alloy in which a constituent precipitates from a supersaturated solid solution.

Precipitation Heat Treatment . . . Any of the various aging treatments conducted at elevated temperatures to improve certain mechanical properties through precipitation from solid solution.

Preheating . . . A general term for heating material, as a die in die casting, as a preliminary to operation, to reduce thermal shock and prevent adherence of molten metal.

Pressure Die Casting . . . A British term. See Die Casting.

Pressure-Tight . . . A term describing a casting free from porosity of the type that would permit leaking.

Primary Choke (Choke) . . . That part of the gating system which most restricts or regulates the flow of metal into the mold cavity.

Primary Crystals . . . The first dendritic crystals that form in an alloy during cooling below the liquidus temperature.

Process Capability . . . The amount of variation in the output of a controlled manufacturing process, the range defined by plus or minus three standard deviations.

Product Analysis . . . In castings, the analysis of the actual part as opposed to the analysis of the steel from which the casting was poured.

Proeutectoid . . . The constituent that separates out of a solid solution before the formation of eutectoid.

Profile Tolerances . . . A system of locating and tolerancing developed to control the orientation of rough parts in machine fixtures. From locating points on the casting a "perfect profile" is established for all surfaces and features. A tolerance envelope surrounding that profile defines the limitations of an acceptable part.

Protection Tube . . . A metal, graphite, or ceramic

tube which shrouds and protects the wires of a thermoelectric pyrometer.

psi . . . Pounds per square inch.

Pugmill . . . A mill for mixing foundry sands and sand mixtures consisting essentially of a shaft fitted with plows or paddle wheels which revolve in a tub or vat.

Purging . . . Elimination of air and other undesirable gases from furnaces or heating boxes.

Pyrometallurgy . . . Chemical metallurgical process dependent upon heat.

Pyrometric Cone . . . A slender trihedral pyramid made of a mixture of minerals similar in composition to that of the clay or other refractory being tested. Each cone is assigned a number indicating its fusion temperature.

Pyrometric Cone Equivalent (PCE) . . . An index of refractoriness obtained by heating on a time-temperature schedule a cone of the sample material and a series of standardized pyrometric cones of increasing refractoriness.

Pyrometry . . . A method of measuring temperature with any type of temperature indicating instruments.

Q

Quartz . . . A form of silica occurring in hexagonal crystals which are commonly colorless and transparent, but sometimes also yellow, brown, purple, green, etc. It is the most common of all solid minerals. See also Silica.

Quartzite . . . A compact granular rock composed of quartz. It is a metamorphosed sandstone, and siliceous cement is often so blended with the quartz grains as to give the rock a nearly homogeneous texture. Primary material in silica brick.

Quench Crack . . . A crack resulting from thermal stress induced during rapid cooling or quenching, or from stresses induced by delayed transformations some time after the article has been fully quenched.

Quench Severity . . . The quench severity is characterized by the H value and relates to the rate of temperature change during quenching.

Quenching . . . Rapid cooling for hardening; normally achieved by immersion of the object to be hardened in water, oil, or solutions of salt or organic compounds in water.

R

Radiant Heat . . . Heat communicated by radiation and transmitted by electromagnetic waves.

Radiation Area . . . Any part of an installation accessible to employees in which there exists a radiation level of 7.5 millirem in any one hour or over 150 millirem in any seven consecutive days.

Radiation, Direct . . . All radiation coming from within an x-ray tube and tube housing except the useful beam.

Radiation Hazard . . . Any situation where persons might be exposed to radiation in excess of the maximum permissible dose.

Radioactive Isotopes . . . Varieties of an element possessing the same chemical characteristics but emitting detectable radiations by means of which they can be identified and traced.

Radioactive Material . . . Any compound or element which may emit any or all of the following: alpha and beta particles, electrons, photons, neutrons and gamma and all other emissions which produce ionization directly or indirectly.

Radium . . . A radioactive element with the chemical symbol Ra; radium and its salts are used in gamma-ray radiography because of their radioactivity. Melting point is 700 C (1292 F).

Range . . . The difference between the highest and lowest values of a measurable attribute of the output of a process.

Rapping . . . Knocking or jarring the pattern to loosen it from the sand in the mold before withdrawing the pattern.

Rapping Plate . . . A metal plate attached to a pattern to prevent injury to the pattern and assist in loosening it from the sand.

Rare Earth (RE) . . . Any of a group of 15 similar metals with atomic numbers 57 through 71. Also rare earth element, rare earth metal, lanthanide series, uncommon metals, Mischmetal.

Rare Gases . . . Helium, argon, neon, krypton, xenon and radon.

Receiving Ladle . . . A ladle placed in front of the cupola into which all metal is tapped. It acts as a mixer and reservoir and to smooth out metal flow to the pouring area.

Recrystallization . . . A process whereby the distorted grain structure of cold-worked metals is replaced by a new, strain-free grain structure during annealing above a specific minimum temperature.

Recrystallization Temperature . . . The lowest temperature at which the distorted grain structure of a cold-worked metal is replaced by a new, strain-free grain structure during prolonged annealing. Time, purity of the metal, and prior deformation are important factors.

Reduction . . . The removal of oxygen or addition of hydrogen.

Reflectoscope . . . An instrument for the ultrasonic testing of metals.

Refractory . . . 1) Heat-resistant material, usually non-metallic, used for furnace linings, etc., 2) the quality of resisting heat.

Refractory Clay . . . A clay which fuses at pce 25 (1590 C, 2894 F) or higher.

Regression Analysis . . . A statistical method of determining, or predicting, the value of a dependent variable, based on levels of one or more known independent variables.

Release Agent (Parting Agent) . . . A material, as silicone, stearate, oil, or wax for lubricating a die pattern or core box to facilitate easy removal of a casting, mold or core.

Remelt . . . Sprues, gates, risers, and defective castings returned directly to the melting pot.

Residual . . . 1) A trace of original material in a mold cavity after molten metal has been poured, 2) any element remaining in an alloy following melting and casting.

Residual Stress . . . See Stress, Residual.

Respirator . . . A filtering device which covers the nose and mouth and prevents inhalation of dust or fumes; should have the U.S. Bureau of Mines certificate of approval for the specific contaminant being filtered out. Handkerchiefs and gauze masks give little or no protection.

Rigging . . . Gates, risers, loose pieces, etc., needed on the pattern to produce a sound casting.

Rimmed Steel . . . A low-carbon stel.

Ringelmann's Scale . . . In air pollution control, a black and white mesh scale reading from all clear to solid black, used to measure the density of smoke. Observer normally uses chart comparator 50 feet from the point where smoke emits.

Riser . . . Reservoir of molten metal from which casting feeds as it shrinks during solidification.

Riser, Blind . . . A riser that does not break through the top of the cope and is entirely surrounded by sand; often combined with skim gates and together forming an efficient method of gating and feeding a casting.

Riser Distance . . . The length of the riser neck. The term is applied to side risers only.

Riser-Gating . . . Practice of running metal for the casting through the riser to help directional solidification.

Riser Height . . . The distance from the top of the riser when liquid to the top of the riser neck. Riser height when solid is usually several inches less than

when liquid because of contraction and loss of feed metal to the casting.

Riser Neck . . . The connecting passage between the riser and casting. Usually only the height and width or diameter of the riser neck are reported, although the shape can be equally important.

Riser, Open . . . Conventional form of riser usually located at the heaviest section of the casting and extending through the entire height of the cope.

Riser Pad (Riser Contact) . . . An enlargement of the riser neck where it joins the casting. The purpose of the pad is to prevent the riser from breaking into the casting when it is struck or cut from the casting.

Riser, Side (Side Head) . . . A riser attached to the side of a casting.

Riser, Top (Top Head) . . . A riser attached to the top surface of a casting.

Rockwell Hardness . . . See Hardness.

Rodding . . . Reinforcing the sand in a core with metal rods or shapes to strengthen parts of the core.

Rolling Over . . . The operation of reversing the position of a flask. If the drag part of the pattern has been rammed with the parting surface downward, it is rolled over 180° to allow core setting and placement of cope.

Rollover Board . . . A wood or metal plate on which the pattern is laid top face downward for ramming the drag half mold, the plate and half mold being turned over together before the joint is made.

Rollover Machine . . . A molding machine with which the flask is rolled over before the pattern is drawn from the mold.

Runner . . . A channel through which molten metal or slag is passed from one receptacle to another; in a mold, the portion of the gate assembly that connects the downgate or sprue with the casting ingate or riser. The term also applies to similar portions of master patterns, pattern dies, patterns, investment molds and finished castings.

Runner Extension . . . In a mold, that part of a runner which extends beyond the farthest ingate as a blind end. It acts as a dirt trap since the first rush of metal along the runner will pick up any loose particles of sand or dirt and carry them into the extension and not into the mold cavity.

Runner Riser . . . A conventional runner, usually in the horizontal plane, which permits flow of molten metal to the ingate and is large enough to act as a reservoir to feed the casting.

Runout . . . 1) A casting defect caused by incomplete filling of the mold due to molten metal draining or leaking out of some part of the mold cavity during pouring; escape of molen metal from a furnace, mold,

or melting crucible, 2) the actual piece of metal that "runs out" of the mold.

S

SAE Specifications . . . A set of materials specifications issued by the Society of Automotive Engineers, Inc.

Safety Goggles . . . Shatterproof, side-shielded eye protectors of nonmagnifying or prescription lenses to prevent permanent injury to eyes or temporary loss of use. Wearing is mandatory for all personnel in specified work areas in most foundries.

Sag . . . A decrease in metal section in a casting due to sagging of the cope or core.

Salamander . . . 1) A heating device, usually of drum shape, in which fuel is burned in the open air by natural draft, 2) iron which has collected in the bottom of a blast furnace during a blow.

Salt Bath . . . A bath of molten salts used for heating steels, for hardening or tempering.

Sand (See AFS for standards) . . . In metalcasting, a loose, granular material high in SiO_2 resulting from the disintegration of rock. The name sand refers to the size of grain and not to mineral composition. Diameter of the individual grains can vary from approximately 6 to 270 mesh. Most foundry sands are made up principally of the mineral quartz (silica). Reason for this is that it is plentiful, refractory, and cheap; miscellaneous sands include zircon, olivine, chromite, CaCO_3 , black sands (lava grains), titanium minerals, and others.

Sand Casting . . . Metal castings produced in sand molds.

Sand Control . . . Procedure whereby various properties of foundry sand, such as fineness, permeability, green strength, moisture content, etc., are adjusted to obtain castings free from blows, scabs, veins, and similar defects.

Sand Expansion . . . Maximum dimensional increase which a sand undergoes when heated to a given temperature.

Sand Inclusions . . . Sand which has loosened from the mold and become entrapped in the molten metal.

Sand Match . . . An extra cope mold used for obtaining a desired parting in irregularly shaped patterns.

Sand Mulling . . . A method of evenly distributing the bond around the sand grain by a rubbing action.

Sand Plow . . . A bladed device used to divert sand from a belt conveyor into a sand hopper.

Sand Porosity . . . Volume of the pore spaces or voids in a sand. (Not synonymous with permeability).

Sand Reclamation . . . Processing of used foundry

sand grains by thermal, air, or hydraulic methods so that it may be used in place of new sand without substantially changing current foundry sand practice.

Sand Spun Process . . . A centrifugal casting technique for producing short lengths of cylindrical shapes.

Sand, Tempering . . . Dampening and cutting over or otherwise mixing sand to produce uniform distribution of moisture, and allowing time for migration of water molecules.

Sand Wall . . . Temporary independent wall separated from a slag pocket wall; facilitates slag removal and protects permanent wall.

Scab . . . A defect on the surface of a casting which appears as a rough, slightly raised surface blemish, crusted over by a thin porous layer of metal under which is a honeycomb or cavity that usually contains a layer of sand; defect common to thin-walled portions of the casting, or around hot areas of the mold.

Scaling (Scale) . . . Surface oxidation, partially adherent layers of corrosion products, left on metals by heating or casting in air or in other oxidizing atmospheres.

Scarfig . . . Cutting off surface projections such as gates and risers from castings by means of a gas torch.

Scrap (Metal) . . . Metal to be remelted; includes scrapped machinery and fabricated items such as rail or structural steel and rejected castings.

Screen Analysis (Sieve Analysis) . . . Distribution of particle size sand expressed in terms of the percentage of weight retained on each of a series of standard screens decreasing in mesh size and the percentage passed by the screen of finest mesh.

Screen (Sand) . . . A sieve or riddle with openings of definite size used to separate one grain size from another or to remove lumps from sand.

Scrubbers . . . See Wet Scrubbers.

Sealed Source . . . Any radioactive material that is encased in and is to be used in a container in a manner intended to prevent leakage of the radioactive material.

Seam . . . A surface defect on a casting related to but of lesser degree than a Cold Shut; a ridge on the surface of a casting caused by a crack in the mold face.

Segregation . . . A casting defect, a concentration of alloying elements at specific regions, usually as a result of the primary crystallization of one phase with the subsequent concentration of other elements in the remaining liquid. Micro segregation refers to normal segregation on a microscopic scale whereby material richer in an alloying element freezes in successive layers on the dendrites (coring) and in constituent network. Macro-segregation refers to gross differences in concentration (for example, from one area of a casting to another) which may be normal, inverse or gravity segregation.

Selenium . . . A metalloid melting at 220 C (428 F), added to stainless steel to improve machinability.

Self-Curing Binder . . . A material used in core making that sets up to form hard cores without heat or other additional assistance.

Separator . . . A mechanical unit which separates or grades ground materials into constituent parts, used in the foundry to remove fines from the system sand and dust from the air.

SFSA . . . Steel Founders' Society of America, 20611 Center Ridge Road, Rocky River, OH 44116.

Shakeout . . . 1) The operation of removing castings from the mold, 2) a mechanical unit for separating the molding materials from the solidified metal casting.

Shank . . . The handle attached to a ladle.

Shaw (Osborn-Shaw) Process . . . A precision casting technique in ceramic molds in five stages requiring no wax or plastic investment: 1) oversize model with one contraction allowance for the freezing metal, 2) bench master patterns cast in hard plaster of paris, 3) accurate refractory cope and drag molds from these patterns (average time to prepare 3 min.), 4) mold firing or curing, 5) pouring.

Shear . . . A type of deformation in which parallel planes in the metal crystals slide so as to retain their parallel relation.

Shear Strength . . . Maximum shear stress a material is capable of withstanding without failure.

Shell Molding . . . A process for forming a mold from resin-bonded sand mixtures brought in contact with pre-heated (300-500 F) metal patterns, resulting in a firm shell with a cavity corresponding to the outline of the pattern.

Shift . . . A casting defect caused by mismatch of cope and drag or of cores and mold.

Shortness (Hot) . . . Brittleness in a metal at an elevated temperature.

Shotblasting (Shot Peening) . . . Casting cleaning process employing a metal abrasive (grit or shot) propelled by centrifugal or air force.

Shrink . . . The difference in volume between liquid metal and solid metal or the void (shrink hole) left in a casting because of it.

Shrinkage . . . 1) Liquid, contraction in volume as metal cools to solidification, 2) solidification, contraction in volume when the metal passes from the liquid to the solid at the freezing point (may extend over a range), 3) solid, the contraction on cooling from freezing point to normal temperature, 4) the decrease in dimension in clays occurring when drying at 100 C (212 F) and even more so on firing, 5) reduction in dimensions of refractory material during heating.

Shrinkage Cracks . . . Cracks that form in metal as

a result of the pulling apart of grains by contraction before complete solidification.

Shrinkage, Patternmakers . . . A linear scale or ruler, typically in inches or millimeters which has been lengthened by the percentage of linear shrinkage by which liquid metal contracts during solidification and cooling. Use of these rules simplifies the construction of patterns and core boxes which must be sized to compensate for metal contraction in the mold.

Sieve Analysis . . . See Screen Analysis.

Silica . . . Silicon dioxide, the prime ingredient of sand and acid refractories.

Silica Brick . . . Refractory material of ganister, bonded with hydrated lime, and fired at high temperature.

Silica Gel . . . A colloidal form of silica used as a drying agent.

Silica Sand . . . Sand with a minimum silica content of 95% used for forming casting molds.

Silicon . . . An important element, chemically classed as a nonmetal, metallurgically, a metal, resembling carbon in chemical properties, used extensively in ferrous and nonferrous alloys; melting point 1423 C (2593.4 F).

Sintering . . . The bonding of adjacent surfaces of particles of a mass of powder or a compact by heating to a suitable temperature and cooling.

Sintering Point . . . That temperature at which the molding material begins to adhere to the casting, or in a test when the sand coheres to a platinum ribbon under controlled conditions. Also, the temperature at which sand grains begin to adhere to one another.

Skewed Tolerances . . . Tolerances which are non-symmetrically distributed about the design parameter.

Skim Core (Skimmer) . . . A flat core or tile placed in a mold to skim a flowing stream of metal. Commonly used in pouring basins, it holds back slag and dirt while clean metal passes underneath to the downsprue. See Core Strainer.

Skim Gate . . . A gating arrangement which changes the direction of flow of molten metal and prevents the passage of slag and other undesirable materials into the mold cavity.

Skimming . . . Removing or holding back dirt or slag from the surface of the molten metal before or during pouring.

Skin . . . A thin surface layer different chemically or structurally from the main mass of a metal object.

Skin-Drying . . . Drying the surface of the mold by direct application of heat.

Slab Core . . . Flat, plain core.

Slag Inclusion . . . Nonmetallic solids entrapped in solid metal.

Slag Stringer . . . An elongated slag inclusion.

Slag Trap . . . An enlargement, dam, or extrusion in the gating or runner system in a mold for the purpose of preventing molten slag particles from entering the mold cavity. See Dirt Trap.

Slicking (Sleeking) . . . Smoothing the surface of molds.

Slip Casting . . . In ceramics, a pouring slip, a water suspension of finely ground clay, into a plaster of paris mold. After it hardens it is dried and fired.

Slurry . . . A term loosely applied to any clay-like dispersion. It may be used to wash ladles or other refractory linings to impart a smoother surface; as a bonding addition to molding sand; as a thin loam over specially made molds or as a mixture to fill in joints or cracks of a core, etc.

Smelting . . . A metallurgical thermal process in which a metal is separated in fused form from nonmetallic materials or other undesired metals with which it is associated.

Smoke . . . A type of emission resulting from incomplete combustion and consisting predominantly of small gasborne particles of combustible material present in sufficient quantity to be observable independently of the presence of other solids in the gas stream.

Soaking . . . Prolonged heating of a metal, furnace or ladle at a selected temperature.

Society of Automotive Engineers, Inc. . . . 400 Commonwealth Drive, Warrendale, PA 15096.

Sodium Silicate . . . See Water Glass.

Softening . . . A process used to soften metals through annealing or tempering.

Soldering . . . 1) Joining metals by fusion of alloys that have relatively low melting points—most commonly, lead-base or tin-base alloys, which are the soft solders. Hard solders are alloys that have silver, copper, or nickel bases, and use of these alloys with melting points higher than 800 F (426.67 C) is generally termed brazing, 2) the sticking or adhering of molten metal to portions of a die.

Solid . . . That material which has a tendency to resist any attempt to change its size or shape.

Solidification . . . The physical process of change from a liquid to a solid state.

Solidification, Shrinkage . . . The decrease in size accompanying the freezing of a molten metal.

Sonic Testing . . . Using sound waves above audible frequency via a supersonic reflectoscope to measure time sound waves taken returning from opposite sides of casting. Defects return the waves in more or less time.

Sorbite . . . Tempered martensite that has a microstructure of distinctly granular appearance. Further

tempering causes the appearance of clearly resolvable carbide particles (spheroidite).

Spark Test . . . A method of determining approximate composition of steel by producing sparks on a grinding wheel.

Specific Gravity . . . A numerical value representing the weight of a given substance as compared with the weight of an equal volume of water at 39 F (3.9C), for which the specific gravity is taken as 1,000. See Density.

Specific Heat . . . Equivalent to thermal capacity, or the quantity of heat required to produce a unit change in the temperature of a unit mass.

Specific Volume . . . Volume of one gram of a substance at a specific temperature, usually 20 C (68 F).

Spheroidite . . . A cementite aggregate of globular carbide and ferrite.

Spheroidized Cementite (Divorced Pearlite) . . . The globular condition of iron carbide after a spheroidizing treatment.

Spiegeleisen (Spiegel) . . . Alloy of iron and manganese used in basic and acid open hearth steelmaking practice. A high manganese pig iron, usually containing 15% or 20% Mn and 4.5–6.5% C.

Spiral Test . . . A method of interpreting the fluidity of an alloy by pouring molten metal into a mold with a long narrow channel. The length of such casting, under standardized conditions, is taken as the fluidity index of that alloy.

Splash Core . . . A core of tile placed in a mold to prevent erosion of the mold at places where metal impinges with more than normal force. Splash cores are commonly used at the bottom of large rammed pouring basins, at the bottom of long downsprues, or at the ingates of large molds.

Spongy Casting . . . A casting in which the metal is porous and dendritic.

Spout . . . A trough through which the metal flows from the furnace to the ladle.

Spray Quenching . . . After solution heat treating, a mode of quenching in which a spray of water is directed upon material just removed from the furnace.

Sprue Base . . . An enlargement or rounded section at the bottom of the downsprue, used to help streamline the flow of metal into the runner, lowering the velocity.

Sprue Button . . . A print attached to the top or squeeze board of a mold to make an impression in the cope indicating where the sprue should be cut.

Sprue Cutter . . . A metal tool used in cutting the pouring aperture, the sprue hole.

Sprue Hole . . . The opening through which the metal is poured into the cope to run into the casting cavity.

Squeeze Board . . . A board used on the cope half of the mold to permit squeezing of the mold.

Squeeze Head . . . In certain types of molding machines, a stationary or movable plate against which a filled mold is compressed, in order to complete the ramming of the sand.

Squeezer Machine . . . A power-operated, usually pneumatic, device used to pack sand into a flask.

Stack Molding . . . See Multiple Mold.

Stainless Steel . . . A wide range of steels containing chromium or chromium and nickel, exhibiting high resistance to corrosion.

Standard Deviation . . . A statistical quantity used to describe the variation of a measurable attribute about some average value.

Standard Pattern . . . A pattern of high-grade material and workmanship in daily use or at frequent intervals. A pattern used as a master to make or check production patterns.

Standard Sample . . . A sample of known composition used to calibrate an instrument or method of analysis.

Standard Shapes . . . Refractory units stocked by manufacturers or made from stock molds.

Stave Construction . . . Attaching staves to polygon-shaped heads in the building of cylindrical bodies; also, standard method used in making semicircular core boxes.

Steel . . . An alloy of iron and carbon that may contain other elements and in which the carbon content does not exceed about 1.7%; it must be malleable at some temperature while in the as-cast state.

Steels, SAE . . . Common designation for the standard grades of steels approved by the Society of Automotive Engineers.

Stellite . . . Proprietary name of a group of complex alloys retaining their hardness strength and resistance to oxidation at high temperatures; contains W, Co, Cr and C.

Stepped Construction . . . In patternmaking, the courses of material that when fastened together resemble steps.

Sticker . . . A lump on the surface of a casting caused by a portion of the mold face sticking to the pattern. Also, a forming tool used in molding.

Stock Allowance . . . Material added to a part to allow for surface preparation or precise dimensioning by machining.

Stock Core . . . Core of standard diameter usually made on a core machine and kept on hand, sawed to required length.

Stool . . . Support for a green sand core on a molding machine.

Stool Plate . . . Plate on a molding machine on which stools are mounted.

Stooling . . . Supporting green sand cores in machine molding while pattern is being withdrawn.

Stopper Head . . . A refractory shape, usually clay and graphite, seated in a ladle's nozzle.

Stopper Rod . . . A device in a bottom-pour ladle for controlling the flow of metal through the nozzle into the casting. The stopper rod consists of a steel rod, protecting sleeves, and a graphite stopper head.

Stopping-Off . . . Filling in a portion of a mold cavity which is not to be cast.

Strained Castings . . . A phrase used to describe the result when molten metal is poured into the mold at too fast a rate or under too great metallstatic pressure, causing the cope to rise slightly from the drag and resulting in an oversize casting.

Strainer Core . . . See Core, Strainer.

Streamline Flow . . . Steady flow of liquid without variance of direction and subsequent eddying.

Strength, Baked . . . Compressive, shear, tensile, or transverse strength of a molded sand mixture when baked at a temperature above 230 F (110 C) and then cooled to room temperature.

Strength, Compressive . . . See Compressive Strength.

Strength, Impact . . . See Impact Strength.

Strength, Retained . . . Compressive, shear, tensile, or transverse strength attained by a sand mixture after being subjected to a cycle or cycles of heating and cooling which approximate foundry practice.

Strength, Shear . . . See Shear Strength.

Strength, Tensile . . . See Tensile Strength.

Strength, Yield . . . See Yield Strength.

Stress-Corrosion Cracking . . . Spontaneous failure of metals by cracking under combined conditions of corrosion and stress, either residual or applied.

Stress Relieving . . . A heat treatment to reduce residual stresses followed by sufficiently slow cooling to minimize development of new residual stresses.

Stress, Residual . . . Those stresses set up in a metal as a result of nonuniform plastic deformation or the unequal cooling of a casting.

Strike-Off . . . Operation of removing excess sand from top of core box or flask.

Stripper Pins . . . On certain molding machines, a series of pins (usually four in number) which support the rammed flask-half at the parting surface so that the mounted pattern may be drawn by lowering.

Stripping . . . Removing the pattern from the mold or core box from core.

Stripping Time . . . In oil-oxygen and nobake mix-

tures, the moment when the core box may be satisfactorily drawn from the core, or pattern from the sand.

Structure (Cast Structure) . . . The size and disposition of the constituents of a metal as cast.

Styrofoam Pattern . . . Expendable pattern of foamed plastic, especially polystyrene, used in manufacturing castings by the Full-Mold process.

Subcutaneous Blowhole . . . Blowholes at or near the surface of solidified metal, covered with a thin layer of metal. May also be called pinhole porosity.

Subzero Treatment . . . Refrigeration of steel to promote transformation of retained austenite.

Sulfur . . . A nonmetallic element, melting point 444 C (831.2 F) occurring as an undesirable tramp (trace) element in most ferrous alloys.

Sulfur Prints . . . A macrographic method of examining for the distribution of sulfide impurities, in which a sheet of wet acidified bromide paper is placed on the polished surface to be examined.

Superalloy . . . An alloy developed for very high temperature use where relatively high stresses are encountered and where oxidation resistance is needed.

Supercooling . . . Lowering the temperature of a molten metal below its liquidus during cooling.

Superduty Fireclay Brick . . . Having pce above 33 with less than 1.0 percent linear shrink in the 2910 F (1599 C) reheat test, and less than 4.0 percent loss in panel spalling test preheated at 3000 F (1649 C).

Superheat . . . Any increment of temperature above the melting point of a metal; sometimes construed to be any increment of temperature above normal casting temperatures introduced for the purpose of refining, alloying or improving fluidity.

Supersaturated . . . Metastable solution in which the dissolved material exceeds the amount the solvent can hold in normal equilibrium at the temperature and under the other conditions that prevail.

Supersonic Reflectoscope . . . An instrument for sending, receiving, and measuring sound waves over 20,000 cycles per second.

Supramor . . . An electromagnetic flaw detection ink for the rapid detection of subcutaneous and surface flaws in ferrous metals.

Surface Hardening . . . Conferring a superficial hardness to a steel while maintaining a relatively soft core.

Surface Texture . . . The roughness, waviness, lay, or other characteristics of the surface of a part.

Surfacing . . . Depositing a filler metal on a metal surface by any method to obtain certain desired properties or dimensions.

Swell . . . A casting defect consisting of an increase

in metal section due to the displacement of sand by metal pressure.

Swing Frame Grinder . . . A device for grinding large castings where the work remains stationary. This grinder, too large to be hand lifted, is usually suspended from a hoist.

Synthetic Molding Sand . . . Any sand compounded from selected individual materials which, when mixed together, produce a mixture of the proper physical and mechanical properties from which to make foundry molds.

System Sand . . . Foundry sand used in making molds and which eventually becomes the bulk of the sand used in the mechanical system or mechanized unit. See also Sand.

T

Tap Hole . . . Opening in the furnace breast through which the molten metal is tapped into the spout.

Temper . . . 1) The moisture content of a sand at which any certain physical test value is obtained, i.e., temper with respect to green compressive strength, permeability, retained compressive strength, etc., 2) to mix material with enough liquid to develop desired molding properties, 3) reheating, hardened, normalized, or mechanically worked steel to a temperature below the critical range to soften it and improve impact strength.

Temper Brittleness . . . Brittleness that results when certain steels are held within or are cooled slowly through a certain range of temperature below the transformation range. The brittleness is revealed by notched-bar impact tests at room temperature or lower temperatures.

Temper Stressing . . . Quenching in water from the tempering temperature to improve fatigue strength.

Temper Water . . . Water added to sand to give proper molding consistency.

Temperature . . . Degree of warmth or coldness in relation to an arbitrary zero measured on one or more of accepted scales, as Centigrade, Fahrenheit, etc.

Temperature, Effective . . . An arbitrary index combining into a single value the effect of temperature, humidity and air movement on the sensation of warmth or cold felt by the human body.

Temperature, Holding . . . 1) Temperature above the critical phase transformation range at which castings are held as a part of the heat treatment cycle, 2) The temperature maintained when metal is held in a furnace, usually prior to pouring.

Temperature, Pouring . . . The temperature of the metal as it is poured into the mold.

Tensile Strength . . . The maximum stress in uniaxial

tension testing which a material will withstand prior to fracture. The ultimate tensile strength is calculated from the maximum load applied during the test divided by the original cross sectional area.

Ternary Alloy . . . An alloy that contains three principal elements.

Test Lug . . . An earlike projection cast as part of the casting and later removed for testing purposes.

Thermal Conductivity . . . The property of matter by which heat energy is transmitted through particles in contact. For engineering purposes, the amount of heat conducted through refractories is usually given in Btu per hour for one square foot of area, for a temperature difference of one degree fahrenheit, and for a thickness of one inch, Btu/hr-ft²-F/in.

Thermal Contraction . . . The decrease in a linear dimension and volume of a material accompanying a change of temperature.

Thermal Expansion . . . The increase in a linear dimension and volume of a material accompanying a change of temperature.

Thermal Fatigue . . . Failure resulting from rapid cycles of alternate heating and cooling.

Thermal Shock . . . Stress developed by rapid and uneven heating of a material.

Thermal Spalling . . . Breaking up of refractory from stresses which arise during repeated heating and cooling.

Thermal Stability . . . Resistance of a material to drastic changes in temperature.

Thermocouple . . . A device for measuring temperatures by the use of two dissimilar metals in contact; the junction of these metals gives rise to a measurable electrical potential which varies with the temperature of the junction. Thermocouples are used to operate temperature indicators or heat controls.

Thermography . . . 1) The technique of obtaining a photographic record of heat distribution in a solid or fluid, 2) a raised printing process employing heat.

Tie Bar, Rod . . . Bar or rod-shaped part of the casting added to prevent distortion caused by uneven contraction between separated members.

Tight Flask . . . 1) A flask with a rigid framework as opposed to a snap flask. 2) A type of flask which remains on mold during pouring. Lugs are normally provided for clamping cope and drag together for pouring.

Tile . . . Rectangular refractory shape larger than brick and usually comparatively thin.

Titanium . . . A white metallic element, melting point 1660 C (3020 F), having a high strength-to-weight ratio; useful in aircraft parts.

Tolerance . . . The permissible deviation of a dimen-

sion from the nominal or desired value. Minimum clearance between mating parts.

Tool Steel . . . Any high-carbon or alloy steel used to make a cutting tool for machining metals and for metal-casting dies.

Tooling Points . . . The fixed positions used for reference during layout and machining.

Torsion . . . Strain created in a material by a twisting action.

Toughness . . . The ability of the metal to absorb energy and to deform plastically during fracture. Toughness values obtained in testing depend upon the test temperature, the rate of loading, the size of the test specimen, as well as the presence of a notch and its acuity.

Tower Oven . . . Vertical, continuous core oven with suspended shelves attached to sprocket-driven chains.

Trace . . . Extremely small quantity of an element, usually too small to determine quantitatively.

Tramp Element (Trace) . . . Contaminant in the components of a furnace charge, or in the molten metal or castings, whose presence is felt to be either unimportant or undesirable to the quality of the casting.

Transfer Ladle . . . A ladle that may be supported on a monorail or carried in a shank and used to transfer metal from the melting furnace to the holding furnace or from furnace to pouring ladles.

Transformation (Temperature) Range . . . The critical temperature at which a change in phase occurs. To distinguish between the critical points in heating and cooling those in heating are referred to as the Ac points (c for Chauffage or heating) and Ar for cooling (r for Refroidissement).

Tungsten . . . Steel-gray, metallic element, mp 3380 C (6116 F), used for electric lamp filament, x-ray tube target, and as alloy element in high-speed steels.

Turntable . . . The base on which a centrifugal casting mold rests.

U

Ultimate Tensile Strength (UTS) . . . The maximum tensile stress a metal can stand. See Tensile Strength.

Ultrasonic Cleaning . . . Immersion cleaning aided by ultrasonic waves which cause microagitation.

Ultrasonic Testing . . . A nondestructive method of testing metal for flaws based on the fact that ultrasonic waves are reflected and refracted at the boundaries of a solid medium.

Unkilled Steel . . . A wild steel insufficiently deoxidized so that it evolves gas and blowholes during solidification.

Upgrading . . . In castings, the removal and repair

of discontinuities to raise the quality level of the casting beyond that which can be economically achieved by good foundry practice.

Urea Formaldehyde Resin . . . A thermosetting product of condensation from urea or thio-urea and formaldehyde, soluble in water and used as a sand binder in core and mold compounds.

V

Vacuum Casting . . . A casting process in which metal is melted and poured under very low atmospheric pressure; a form of permanent mold casting where the mold is inserted into liquid metal, vacuum is applied, and metal drawn up into the cavity.

Vacuum Degassing . . . The use of vacuum technique to remove dissolved gases from molten alloys.

Vacuum Refining . . . Melting in a vacuum, usually by electrical induction, to remove gaseous contaminants from the metal.

Value Analysis . . . In manufacturing, an analysis to determine the most economical method of manufacturing, taking into account the cost and the process capability of alternate manufacturing system(s) under consideration, their degree of variation, the benefits of the resultant product, and desired quality and production quantity and rate.

Vanadium . . . A white, hard, metallic element, mp 1800 C (3272 F), used as an alloy in iron and steel; a powerful carbide stabilizer and deoxidizer.

Vegetable Oils . . . Oils extracted from plants, used as drying oils in core oil manufacture. Linseed oil is an example.

Veining . . . A defect on the surface of a casting appearing as fins, veins or wrinkles and associated with excessive thermal movement of the sand, especially core sands.

Venting . . . Perforation with a vent wire of the sand over and around a mold cavity to assist in the escape of the gases.

Vertical Axis Casting Machine . . . A centrifugal casting machine in which the axis of rotation of the mold is vertical.

Vibrator . . . A device, operated by compressed air or electricity, for loosening and withdrawing patterns from a mold, or for vibrating a hopper or chute to promote the flow of material from the hopper or chute.

Vickers Diamond Pyramid Hardness Tester . . . Patented indentation hardness machine. See Hardness.

Virgin Metal (Primary Metal) . . . Metal extracted directly from the ore; not previously used.

Viscosity . . . The resistance of fluid substance to flowing, quantitatively characteristic for an individual substance at a given temperature and under other

definite external conditions.

Void . . . A shrinkage cavity produced in castings during solidification.

W

Warpage . . . Deformation other than contraction that develops in a casting between solidification and room temperature; also, distortion occurring during annealing, stress relieving, and high-temperature service.

Wash . . . A casting defect resulting from erosion of sand by metal flowing over the mold or corded surfaces. They appear as rough spots and excess metal on the casting surface. Also called cuts.

Washburn Core . . . A thin core which constricts the riser at the point of attachment to the casting. The thin core heats quickly and promotes feeding of the casting. Riser removal cost is minimized.

Water Test . . . To subject a casting to water pressure in such a manner that any porous areas will show leakage.

Water Glass . . . Sodium silicate, a viscous liquid which when mixed with powdered fireclay forms a refractory cement; used in CO₂ Molding.

Wax Pattern . . . 1) A precise duplicate, allowing for shrinkage, of the casting and required gates, usually formed by pouring or injecting molten wax into a die or mold, 2) wax molded around the parts to be welded by a thermit welding process.

Wear . . . The undesired deterioration of a component by the removal of material from its surface.

Weld Bead . . . The built-up portion of a fusion weld, formed either from the filler metal or from the melting of the parent metal.

Welding . . . A process used to join metals by the application of heat. Fusion welding, which includes gas, arc, and resistance welding, requires that the parent metals be melted. This distinguishes fusion welding from brazing. In pressure welding joining is accomplished by the use of heat and pressure without melting. The parts that are being pressure welded are pressed together and heated simultaneously, so that recrystallization occurs across the interface.

Welding, Arc . . . Welding accomplished by using an electric arc that can be formed between a metal or carbon electrode and the metal being welded; between two separate electrodes, as in atomic hydrogen welding or between the two separate pieces being welded, as in flash welding.

Welding, Autogenous . . . Method of uniting two pieces of metal by melting their edges together without solder or any added welding metal, as by the thermit process which employs a medium of finely divided aluminum powder and oxide or iron by which a temperature of some 5400 F (2982.2 C) is obtained.

Welding, Electrode . . . A metal or alloy in rod or wire form used in electric arc welding to maintain the arc and at the same time supply molten metal or alloy at the point where the weld is to be accomplished.

Welding Flash . . . Skin exposed too long to the ultraviolet rays of welding or melting arcs will burn as in a sunburn. Though temporary blindness can result, it is not permanent, as is popularly believed.

Welding, Shielded-Arc . . . Electric-arc welding in which the molten weld metal is protected from the atmosphere. An inert gaseous atmosphere or flux-coated electrode may be employed.

Welding Stress . . . That stress resulting from localized heating and cooling of metal during welding.

Wet Scrubber (Gas Washer) . . . In air pollution control, a liquid (usually water) spray device for collecting pollutants in escaping foundry gases.

Widmannstatten Structure . . . Platelike structure seen in grains of steel in the course of transformation of a solid solution.

Wild Steel . . . Steel which has not been completely deoxidized and reacts violently after casting due to liberation of gases on cooling.

X

X-Ray . . . Form of radiant energy with wavelength shorter than that of visible light and with the ability

to penetrate materials that absorb or reflect ordinary light. X-rays are usually produced by bombarding a metallic target with electrons in a high vacuum. In nuclear reactions it is customary to refer to photons originating in the nucleus as gamma rays and to those originating in the extranuclear part of the atom as x-rays.

Y

Yield . . . Comparison of casting weight to total weight of metal poured into mold.

Yield Ratio . . . The ratio of yield strength to ultimate tensile strength.

Yield Strength . . . The stress at which a material exhibits a specified limiting permanent strain.

Young's Modulus (E) . . . See Modulus of Elasticity.

Z

Zircon . . . The mineral zircon silicate, $ZrSiO_4$, a very high melting point acid refractory material used as a molding material in steel foundries.

Zirconia . . . ZrO_2 an acid refractory up to 2500 C (4532 F) having good thermal shock resistance and low electrical resistivity.

Zirconium . . . Silvery-white, metallic element, mp 1860 C (3380 F), a powerful deoxidizer when added to molten steel.