

The Glossary for

Casting and Molding Processes Definitions

- A -

Abrasive - Any substance used for abrading, such as grinding, polishing, blasting etc., Abrasive materials come in all shapes and forms, powders, bonded to wheels, boards, papers; they can be sand, files, emery, and so on.

Acid - A chemical term to define a material, which gives an acid reaction.

Acid melting - Melting in a furnace with refractory material that has an acid reaction. Material may be silica, sand, siliceous rock, or silica brick.

Acid steel - Steel melted in a furnace which has an acid bottom and lining, under a predominantly siliceous slag.

Additives - Any material added to molding sand for reasons other than bonding or improvement of bond is considered an additive. Bonds can be of varying types: carbonaceous (seacoal, pitch, fuel oil, graphite, gilsonite); cellulose (wood flour, cereal hulls); fines (silica flour, iron oxide, fly ash); cereals (corn flour, dextrine, sugar); and chemical (boric acid, sulfur, ammonium compounds, diethylene glycol).

Aerator - A device for fluffing (or decreasing the density of) and cooling sand by the admixture of air.

AFS fineness number - Approximately the number of meshes per inch of a sieve which just would pass the sand sample if its grains were uniform in size. In other words, it is the average of the grains in the sand sample.

Aging - A change in the metal or alloy by which its structure recovers from an unstable condition produced by quenching (quench aging) or by cold working (strain aging). The change in structure consists in precipitation, often submicroscopic, and is marked by a change in physical properties. Aging which takes place slowly at room temperature may be accelerated by a slight increase in temperature.

Air belt - Chamber, surrounding the cupola at the tuyeres, to equalize the volume and pressure of the blast and deliver it to the tuyeres.

Air channel - A groove or hole which carries the vent from a core to the outside of a mold.

Air control equipment - Any device used to regulate the volume, pressure, or weight of air.

Air dried (dry) - A core or mold dried in air, without application of heat.

Air furnace - A form of reverberatory furnace for melting ferrous and nonferrous metals and alloys. Flame from fuel burning at one end of the hearth passes over the bath to the stack at the opposite end of the furnace.

Air hammer - Chipping hammer operated by compressed air.

Air hardening - Full hardening of a metal or alloy during cooling in air or other gaseous medium from a temperature above its transformation range.

Air hoist - Lifting device operated by compressed air

Air hole - Hole in a casting caused by air or gas trapped in the metal during solidification.

Air injection machine - An early type of die casting machine in which air pressure acting directly on the surface of molten metal in a closed gooseneck forces the metal into the die.

Air setting - The property of some materials to take a permanent set at normal air temperature. Examples are gypsum slurry, investment molding materials, core and mold washes, etc.

Airless blast cleaning - A process whereby the abrasive material is applied to the object being cleaned by centrifugal force generated by a rotating-vane-type wheel.

Alloy - A metallic material formed by mixing two or more chemical elements. Usually possess properties different from those of the components.

Alloying - Procedure of adding elements other than those usually comprising a metal or alloy to change its characteristics and properties.

Alloying elements - Elements added to nonferrous and ferrous metals and alloys to change their characteristics and properties.

Anodizing - Forming a conversion coating on a metal surface by electrolytic oxidation with the work forming the anode; most frequently applied to aluminum.

Antimony - One of the elements; its chemical symbol is Sb. Its formula weight is 121.76, specific gravity 6.62, and melting point 630.5° C.

Antioch process - Plaster molding process using a mixture of about 50% sand, 40% gypsum, and 8% fibrous talc mixed with water in the proportion of 100 parts by weight material with 50 parts water.

Antipiping (material) - Usually refers to an insulating material placed on top of a sprue or riser that keeps the metal in liquid or semiliquid form for a long period of time and minimizes the formation of the usual conical pipe or shrink in the top of a sprue or riser

Arbor - A metal barrel, frame, or plate to support or carry part of a mold or core.

Arrestor, dust - Equipment for removing dust from air.

Assembling (assembly) line - Conveyor system where molds or cores are assembled.

Atmospheric riser (Williams) - Blind riser that employs atmospheric pressure to aid feeding. Insertion of a small sand core into the riser provides a means for ingress of air into the interior of the riser, and forces the metal into the casting cavity.

Atom - The smallest particle of an element.

Austenitic - Usual reference is to an alloy steel or iron with structure at room temperature that is normally composed essentially of austenite.

- B -

Back draft - Taper or draft which prevents removal of pattern from the mold.

Back (backing) sand - Sand between the facing sand and the flask.

Backing board - A second bottom board where molds are opened.

Baffle plate - Plate or wall in a firebox or furnace to change direction of the flame.

Bail - Connection between crane and hook and ladle.

Baked core - One which has been subjected to heating or baking until it is thoroughly dry, as opposed to a green-sand core, which is used in the moist state.

Baked permeability - Property of a molded mass of sand heated at a temperature above 230° F until dry and cooled to room temperature, to permit passage of gases through it; particularly those generated during pouring of molten metal into a mold.

Baked strength - Strength of a sand mixture after it has been baked to above 230° F and cooled to room temperature.

Band, inside - A steel frame placed inside a removable flask to reinforce the sand.

Banking the cupola - Method of keeping cupola hot and ready for immediate production of hot iron after an unexpected shutdown of several hours. Procedure is to drain all molten iron and slag from the cupola, place extra coke on the top charge, and open one or two tuyeres to supply a small natural draft to keep coke combustion going.

Bar - A rib in the flask to help hold the sand.

Basic - A chemical term for a material which gives an alkaline reaction.

Basic bottom or lining (furnace) - Inner lining and bottom of a melting furnace composed of materials having a basic reaction. Materials may be crushed burnt dolomite, magnesite, magnesite brick, or basic slag.

Basic steel - Steel melted in a furnace with a basic bottom and lining under a predominantly basic slag.

Basin - A cavity on top of the cope into which metal is poured before it enters the sprue.

Batch - Amount or quantity of core or mold sand or other material prepared at one time.

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

Baume - Designating or conforming to either of the scales used by the French chemist Antoine Baume in the gradation of his hydrometers for determining the specific gravity of liquids.

Bauxite - An ore of aluminum consisting of moderately pure hydrated alumina, $\text{Al}_2\text{O}_3 \times 2\text{H}_2\text{O}$.

Bed charge - The charge of iron placed on the coke bed in a cupola.

Bed coke - Coke placed in the cupola well to support the following iron and coke charges. -

Bed-in - Method of ramming the drag mold with out rolling it over.

Beehive coke - Coke which is produced in hemispherical ovens about 12 ft. in diameter and charged through the top to form a layer of coal 18 to 24 in. deep. Coke is ignited and air for partial combustion is supplied over the top by doors around the bottom of the ovens. Air burns volatile matter released by coke and during the later stages of carbonization burns some 5 to 8% of the coke.

Bellows - A device operated with both hands, to produce a current of air; some bellows are mechanically operated.

Bench - Frame support on which small molds are made.

Bench molder - Man who makes small molds on a molder's bench.

Bench rammer - A short rammer used by a bench molder.

Bentonite - A widely distributed, peculiar type of clay which is considered to be the result of devitrification and chemical alteration of the glassy particles of volcanic ash or tuff. Used in foundry to bond sand.

Bernoulli's theorem - A theorem which states that in a stream flowing without friction, the total energy in a given amount of the fluid is the same at any point in its path of flow.

Bessemer Process - Method of making steel by blowing air through molten pig or carbon-bearing iron contained in a suitable vessel which causes rapid oxidation of silicon, carbon, etc.

Binary alloy - An alloy of two metals.

Binder - Material to hold the grains of sand together in molds or cores. May be cereal, oil, clay, resin, pitch, etc.

Binder, plastic (resin) - Synthetic resin material used to hold grains of sand together in molds or cores; may be phenol formaldehyde or urea formaldehyde thermosetting types.

Black heart - American type of malleable iron. The normal fracture shows a velvety black appearance having a mouse-gray rim.

Black lead - Graphite for facing molds and cores.

Blacking - Carbonaceous material for coating mold or core surfaces.

Blast - Air driven into the cupola or furnace for combustion of fuel.

Blast cleaning - Removal of sand or oxide scale from castings by the impinging action of sand, metal shot, or grit projected under air, water, or centrifugal pressure.

Blast furnace - Closed-top-shaft furnace for producing pig iron from iron ore.

Blast gate - sliding plate in the cupola blast pipe to regulate the flow of air.

Blast meter - Instrument indicates the volume or pressure, or both, of air passing through the blast pipe.

Blast pressure - Pressure of air in blast pipe or wind belt of the cupola, depending on the location of indicating instrument. Usually given in ounces of water pressure.

Bleed (bleeder, bleeding) - Molten metal oozing out of casting stripped or removed from the mold before solidification.

Blended sand - Mixture of sands of different grain sizes, clay content, etc., to produce one possessing characteristics more suitable for foundry use.

Blind riser - An internal riser which does not reach to the exterior of the mold.

Blister - Defect on the surface of a casting appearing as a shallow blow with a thin film of metal over it. In die-casting, it is a surface bubble or eruption caused by expansion of gas (usually as a result of heating) trapped within the die-casting or beneath the plating on the die-casting.

Blocking the heat - Stopping the carbon drop in production of steel by addition of deoxidizers such as silicomanganese, spiegel, or ferrosilicon and ferromanganese.

Blow - A casting defect due to trapping of gas in molten or partially molten metal.

Blow gun - Valve and nozzle attached to a compressed air line to blow loose sand or dirt from a mold or pattern. Also to apply wet blacking.

Blow hole - The hole or void left in a casting by trapped gas. (See Blow.)

Blow pipe - A small pipe or tube through which the breath is blown to remove loose sand from small molds.

Blower - Machine or device for supplying air under pressure to the melting unit.

Blower, core or mold - Machine using compressed air to inject sand into a corebox or a flask.

Blow plate - Plate on the bottom of the sand hopper on core or mold blower machines which contains holes through which the sand is blown into the core box or flask.

Bod, bott - A piece of clay or other material to stop the flow of metal from the taphole.

Bod (bott) stick - A stick or rod on which the bod is mounted so that it may be forced into the tap hole.

Body core - The main core.

Boil - Agitation of molten metal by steam or gas.

Bond - Cohesive material in sand.

Bond clay - Any clay suitable for use as a bonding material in molding sand.

Bond strength - Resistance of foundry sand to deformation.

Booking - Method of assembling or bringing together two halves of a core in a manner similar to closing a book.

Boric acid - Inhibitor used in facing sand for magnesium-base and aluminum-base alloys high in magnesium to prevent reaction with moisture in the sand.

Borings - Metal in chip form resulting from machining operations.

Boron - One of the elements. Its chemical symbol is B and its atomic weight is 10.82. In the form of borax and boric oxide, it is used as a flux in nonferrous metallurgy, and in the form of an alloy with other elements, as an addition to ferrous alloys.

Boron trichloride - A product used for degasification of aluminum alloys.

Bosh - Sloping of the cupola lining to form a smaller diameter just above the tuyeres.

Boss - Projection (usually of circular cross section) on a casting.

Bottom board - Board supporting the mold.

Bottom doors - Doors underneath the cupola.

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

Bottom pour mold - Mold gated at the bottom.

Bottom sand - Layer of molding sand rammed into place on the doors at the bottom of a cupola.

Bracket - Strengthening strip or rib on a casting.

Branch core - Part of a core assembly.

Branch gate - Two or more gates leading into the casting cavity.

Brass - Copper-base alloy with zinc as the major alloying element.

Brazing - Joining metals and alloys by fusion of nonferrous alloys with melting points above 800° F, but lower than those of the materials being joined.

Breast - Area surrounding the tap hole of a melting furnace.

Breeze - Coke or coal screenings.

Bridge - Material adhering to the cupola wall which slows or prevents descent of the stock charges.

Brinell hardness - Value of hardness of a metal or alloy, tested by measuring the diameter of an impression made by a ball of given diameter applied under a known load. Values are expressed in Brinell hardness numbers.

Briquets - Compact cylindrical or other shaped blocks formed of finely divided materials by incorporation of a binder, by pressure, or both. Materials may be ferroalloys, metal borings or chips, silicon carbide, etc.

Bronze - Copper-base alloy, with tin as the major alloying element.

Buckle - Defect on a casting surface, appearing as an indentation resulting from an expansion scab.

Built-up plate - A pattern plate with the cope pattern mounted on or attached to one side with the drag on the other. (See Match-plate.)

Bulb sponge - Rubber ball with a small piece of sponge inserted in the hole.

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

Burden - Term used to designate the metal charge for a melting furnace. It is also used in cost accounting to indicate certain additional charges to be included in assessing costs in the different areas.

Burn-on - Expression denoting adhesion of sand to the casting, usually due to the metal penetrating into the sand.

Burn-out - Usually refers to removal of the disposable wax or plastic pattern in the investment-molding process by heating the mold gradually to a sufficiently high temperature to consume any carbonaceous residues.

Burner - A device which mixes fuel and air intimately to provide perfect combustion when the mixture is burned. Types include acetylene, oil, gas, powdered coal, stoker, etc.

Bushing - A sleeve, metallic or nonmetallic, usually removable or replaceable, which is placed in a body to resist wear, erosion, etc.

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

- C -

Calcium-aluminum-silicon - An alloy composed of 10-14% calcium, 8-12% aluminum, and 50-53% silicon, used for degasifying and deoxidizing steel.

Calcium boride - An alloy of calcium and boron corresponding (when pure) to the formula CaB_6 , containing about 61% boron and 39% calcium, and used in deoxidation and degasification of nonferrous metals and alloys.

Calcium carbide - A grayish-black, hard crystalline substance made in the electric furnace by fusing lime and coke. Addition of water to calcium carbide forms acetylene and a residue of slaked lime.

Calcium-manganese-silicon - An alloy containing 17-19% calcium, 8-10% manganese, 55-60% silicon, and 0 to 14% iron, used as a scavenger for oxides, gases, and nonmetallic impurities in steel.

Calcium molybdate - A crushed product containing 40-50% molybdenum, 23-25% lime, 3% iron max., and 5-10% silica, used to add molybdenum to iron and steel produced in the open hearth, air furnace, or electric furnace.

Calcium silicon - An alloy of calcium, silicon, and iron, containing 28-35% calcium, 60-65% silicon, and 6% maximum iron, used as a deoxidizer and degasifier for steel and cast iron. Sometimes called calcium silicide.

Captive Foundry - One that is part of a manufacturing plant, and whose products (castings) are used in the plant as parts of finished objects.

Carbide - A compound of carbon with a more positive element, such as iron. Carbon unites with iron to form iron carbide or cementite, Fe_3C .

Carbon boil - Refers to the practice of adding oxidizing agents such as iron ore or oxygen to molten steel in the furnace to react with carbon and create a boiling action. In addition to reducing the carbon content, it removes occluded gasses such as hydrogen, oxygen, and nitrogen.

Carbon equivalent - Relationship of total carbon, silicon, and phosphorus in gray iron, expressed by the formula: $\text{CE} = \text{TC}\% + \text{Si}\%/3 + \text{P}\%/3$.

Carbon steel - Steel which owes its properties chiefly to various percentages of carbon without substantial amounts of other alloying elements; also known as ordinary steel or straight carbon or plain carbon steel.

Cast iron - Generic term for a series of alloys of iron, carbon, and silicon, in which the carbon is in excess of the amount which can be retained in solid solution in austenite at the eutectic. When cast iron contains a specially added element or elements in amounts sufficient to produce a measurable modification of the physical properties under consideration, it is called alloy cast iron. Silicon, manganese, sulfur, and phosphorus, as normally obtained from raw materials, are not considered as alloy additions.

Cast plate - Metal plate, usually aluminum, cast with the cope pattern on one side and the drag pattern on the other. (See Matchplate.)

Cast-weld assembly - Welding one casting to another to form a complete assembly.

Casting (noun) - Metal poured into a mold to form an object.

Casting (verb) - Act of pouring molten metal into a mold.

Casting Industry - Is the sixth largest Industry in North America, behind Petroleum, Agriculture, Lumber, Mining, Textile, Transportation (this data from AFS). The Casting Industry is the making of products from metals, earth, glass, etc. The purpose and direction here in the Wynn Danzur Web-Site will be to learn about ferrous, nonferrous, and exotic metal castings and all that goes along with these elements. Further information can be acquired by writing or contacting Wynn Danzur, these information centers are located through out this web-site.

Casting, machine (verb) - Process of casting by machine.

Casting, open sand (noun) - Casting poured into an uncovered mold.

Casting strains - Strains resulting from internal stresses created during cooling of a casting.

Cavity, mold or die - Impression or impressions in a mold or die that give the casting its shape.

Cement - Mineral substances in finely divided form, which are hardened through chemical reaction or crystallization. A common one is portland cement.

Cement molding - Process in which the sand bonding agent is a type of portland cement that develops high strength early in the hardening stage. Approximately 13lb of cement, 6lb of water, and 100lb of clayfree sand are mixed together. Mixture must be used within 3 to 4 hours. Molds are air dried for 72 hours before use.

Cement, refractory - Highly refractory material in paste or dry form, ready to be mixed with water which may be used as a mortar, a patching material, or to form a complete lining in a furnace or other unit where high temperatures are encountered.

Cementation - Process of introducing elements into the outer layer of metal objects by means of high-temperature diffusion.

Cementite - Iron carbide, Fe₃C, a hard brittle, crystalline compound observed in the microstructure of iron-base alloys.

Centrifugal casting - Process of filling molds by pouring the metal into a sand or metal mold revolving about either its horizontal or vertical axis, or pouring the metal into a mold that subsequently is revolved before solidification of the metal is complete. Molten metal is moved from the center of the mold to the periphery by centrifugal action.

Ceramic mold - Mold in which the refractory and binder are such that when fired at high temperature, a rigid structure is formed. Mold can be made in a flask or in the form of a shell.

Cereal - Substance derived principally from corn flour, which is added to the core and molding sands to improve their properties for casting production.

Cerium - Metallic element, malleable and ductile, most abundant of rare-earth group. Atomic weight 140.13, sp. Gr. 7.04, hardness (Moh's) about 2, melting point 640° C. Has exceptionally strong affinity for oxygen, sulfur, hydrogen, nitrogen, etc.

Chalk test - Method of crack detection which consists of applying a penetrating liquid to the part, removing the excess from the surface which is then coated with whiting or chalk. After a short time the penetrant seeps out of the cracks into the whiting, causing an appreciable difference in whiteness.

Chamfer - Breaking or beveling the sharp edge or angle formed by two faces of a piece of wood or other material.

Chamotte - Coarsely graded refractory material prepared from calcined clay and ground firebrick mulled with raw clay, used in steel foundries.

Chaplet - Metal supports or spacers used in molds to maintain the cores, or parts of a mold, which are not self-supporting. Chaplets maintain these dimensions during the casting process, they then become part of the casting itself.

Charcoal (pig) iron - Pig iron reduced in a blast furnace, using charcoal as the fuel.

Charging crane - System for charging the melting furnace with a crane.

Charging door - Opening through which the furnace is charged.

Charging floor - Floor from which the furnace is charged.

Charging machine - Machine for charging the furnace, particularly the open hearth.

Charpy test - A pendulum type of impact test which a specimen, supported at both ends as a simple beam, is broken by the impact of the falling pendulum. Energy absorbed in breaking the specimen, as determined by the decreased rise of the pendulum, is a measure of the impact strength of the metal.

Cheek - Intermediate sections of a flask inserted between cope and drag. Necessitated by difficulty in molding unusual shapes, or in cases where more than one parting line is required.

Chill (noun) - A device used to cool an isolated area of a mold.

Chill (verb) - To cool rapidly.

Chill coating - A material applied to metal chills to prevent oxidation or other deterioration of the surface which might result in blows when molten metal comes in contact with the chills.

Chill coils - Chills made of steel wire formed into helical coils or spirals.

Chill nails - Chills in the form of nails.

Chill test - Method of determining the suitability of a gray iron for specific castings through its chilling tendency, as measured from the tip of a wedge-shaped test bar.

Chill zone - Area of a casting in which chilling occurs, as long sharp edges or exterior corners.

Chilled iron - Cast iron poured against a chill to produce a hard, un-machinable surface.

Chip (verb) - To remove extraneous metal from a casting with hand or pneumatically operated chisels.

Chlorination - A refining or degasification process, wherein dry chlorine gas is passed through molten aluminum-base and magnesium-base alloys to remove entrapped oxides and dissolved gases.

Choke - Restriction in a gating system to control the flow of metal beyond that point.

Chromium - Alloying element used as a carbide stabilizer. (See Ferrochromium.) -

Chvorinov's Rule - A rule which states that solidification time is proportional to the square of the volume of the metal and inversely proportional to the square of the surface area, or t (solidification time) = KV^2/SA^2 .

Clamp - A device for holding parts of a mold, flask, corebox, etc., together.

Clamp-off - Indentation on a casting surface due to displacement of sand in the mold.

Clay wash - Clay and water mixed to a creamy consistency.

Clay, refractory - A clay which, in addition to its capability of resisting high temperatures, also possesses strong bonding power.

Cleaning - Process of removing sand, surface blemishes, etc., from the exterior and interior surfaces of castings. Includes degating, tumbling or abrasive blasting, grinding off gate stubs, etc.

Coalescence - Agglomeration of fine particles into a mass. Also growth of particles of a dispersed phase by solution and reprecipitation. Also grain growth by absorption of adjacent undistorted grains.

Cobalt 60 - Radioisotope of the element cobalt used in radiographic examinations of castings, and for determining height of molten metal in cupola well.

Coke - A porous, gray, infusible product resulting from the dry distillation of bituminous coal which drives off the volatile matter. Used as a fuel in cupola melting. Petroleum coke results from distillation of petroleum, and pitch coke from distillation of coal tar pitch. (*See Beehive coke.*)

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

Cold blast pig iron - Pig iron produced in a blast furnace without the use of the heated air blast.

Cold shortness - Brittleness when metal is at a low temperature.

Cold shut - Where two streams of metal do not unite thoroughly in a casting.

Collapsibility - Tendency of a sand mixture to break down under conditions of casting.

Colloids - Finely divided material, less than 0.5 micron (0.00002 in.) in size, gelatinous, highly absorbent, and sticky when moistened.

Columnar structure - Coarse structure of parallel columns of grains caused by highly directional solidification resulting from sharp thermal gradients.

Combination die - A die-casting die having two or more cavities of dissimilar parts. (*See Multiple-cavity die*)

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

Combustibles - Materials capable of combustion; inflammable.

Conductivity - The quality or power of conducting or transmitting heat, electricity, etc.

Compressive strength - The maximum compressive strength which a material is capable of developing.

Continuous annealing furnace - Furnace in which castings are annealed or heat treated by being passed through different zones kept at constant temperatures.

Contraction - Act or process of a casting becoming smaller in volume and/or dimensions during the solidification of the metal or alloy which composes the casting.

Controlled cooling - Process by which a metal object is cooled from an elevated temperature in a predetermined manner of cooling to avoid hardening, cracking, or internal damage.

Converter - Vessel for refining molten metal by blowing air through it. Used in making steel from molten cast iron and in refining copper.

Cooling curve - A curve delineating the relationship between temperature and time during the cooling of a metal or alloy test specimen.

Cope - The upper or topmost section of a flask, mold, or pattern.

Cope, false - A temporary cope which is used only to establish the parting line.

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Core - Separable part of the mold, usually made of sand and generally baked, to create openings and various shaped cavities in the castings. Also used to designate the interior portion of an iron-base alloy which after casehardening is substantially softer than the surface layer or case.

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

Core box - Box with an opening in which the core is formed.

Core blowing machine - Machine which reams the core by blowing sand into the core box.

Core drier (dryer) - Sand or metal supports to keep cores in shape during baking.

Core jig (fixture) - Device in which a number of cores are assembled outside the mold, then used to locate the assembly in the proper position in the mold.

Core machine - Machine for making cores.

Core oil - Linseed-base or other oil used as a core binder.

Core oven - An oven for baking cores.

Core paste - Material in paste form used as an adhesive to join sectional cores.

Core plate - A plate or board made of metal or heat-resisting material on which certain types of cores are baked.

Core print - An extension of the pattern for locating the core or an extension of the mold cavity for locating the core.

Core, ram-up - Core attached to the pattern and rammed up in the mold, where it remains when the pattern is withdrawn.

Core rod - Iron or steel in rod form used to stiffen or support a core internally.

Core sand - Sand for making cores.

Core sand mixer - Equipment in which cores are made.

Core setter - An operator or machine for placing cores in molds.

Core shift - Defect resulting from movement of the core from its proper position in the mold cavity.

Core vents - 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 corebox employed in a core blowing machine.

Core wash - Refractory coating for a core.

Core maker - A person who makes cores.

Coring - Variable composition in solid-solution dendrites' the center of the dendrite is richer in one element, as shown by the pertinent solidus-liquidus lines in a phase diagram.

Core Crack - Appears in a casting after solidification and cooling due to excessive strain generally resulting from nonuniform cooling.

Crack, hot - Developed in a casting before it has cooled completely, and usually due to some part of the mold restraining solid contraction of the metal. (*See Tear, hot.*)

Creep - Time rate of deformation continuing under stress intensities well within the yield point, proportional limit, or the apparent elastic limit for the temperature.

Critical points (temperatures) - Temperatures at which changes in the phase of a metal take place, and are determined by the liberation of heat when the metal is cooled and by the absorption of heat when the metal is heated, resulting in halts or arrests on cooling and heating curves.

Crucible - A ceramic pot or receptacle of graphite-clay, clay, or other refractory material in which metal is melted. This term sometimes applied to pots of cast, iron or cast or wrought steel.

Crucible furnace - Furnace in which metal is melted in crucibles.

Crush - Casting defect appearing as an indentation in the surface due to displacement of sand in the mold; usually at the joint surfaces.

Crystallization - Act or process of forming crystals or bodies formed by element or compounds solidifying so they are bounded by plane surfaces, symmetrically arranged, and are the external expressions of definite internal structure.

Cupola - Stack-type melting unit in which metal is melted in direct contact with the fuel.

Cupola, basic - Cupola with refractory lining which has a basic reaction, usually magnesite, and is operated with slags high in lime. Lining may be neutral material like carbon, used with high lime slags.

Cupola blower - A machine which compresses a large volume of air at low pressure for operation of the cupola.

Cupola dust arrester - A device attached to the stack of a cupola which removes dust and sparks for the outgoing gases.

Cupola, hot blast - Cupola in which the air blast is heated to temperatures from 400° to 1000° F.

Cupola, water-cooled - Cupola in which the melting zone and tuyeres are cooled with water. Cooling of melting zone may be internal through jackets or steel tubing under the refractory lining. Cooling is also accomplished externally by water flowing down the outer shell.

Cutoff machines, abrasive - A machine using a thin abrasive wheel and employed in cutting off gates and risers from casting or in similar operations.

Cuts - Defects in castings resulting from erosion of the sand by the molten metal pouring over the mold or core surface.

Cutter, gate - A piece of sheet metal or other tool for removing a portion of the sand in a mold to form the gate or metal entrance into the casting cavity.

Cutter, sprue - A piece of metal tubing or other tool used to remove a portion of the sand from a mold to form the sprue or passage from the exterior of the mold to the gate. Also a machine used for shearing sprues and gates from castings.

- D -

Damping capacity - The ability to absorb vibration. More accurately defined as the amount of work dissipated into heat by a unit volume of material during a completely reverse cycle of unit stress.

Dana's -* An unsung Cincinnati historical marker; a tradition; home to a muskie.

Daub - To coat or plaster the inside of a cupola at the melting zone or the inside of a ladle with a refractory mixture.

Degasifier - A material employed for removing gases from metals and alloys.

Delta iron - An allotropic (polymorphic) form of iron, stable above 2550° F, crystallizing in the body-centered-cubic lattice.

Dendrite - A crystal formed during the solidification of a metal or alloy characterized by a branching structure like that of a fir tree.

Desulfurizer - A material used to remove sulfur from molten metals and alloys.

Dezincification - Corrosion of some copper-zinc alloys, involving loss of zinc and the formation of a spongy porous copper.

Die-Casting (verb) - Pouring molten metal under pressure into metal molds.

Die-Casting (noun) - Casting resulting from die-casting process.

Die-casting, cold chamber - Type of casting made in a die-casting machine in which the metal injection mechanism is not submerged in the molten metal.

Die-casting, hot chamber - Type of casting made in a die-casting machine in which the metal injection mechanism is submerged in the molten metal.

Dielectric baking - Baking of cores and molds in a field of high-frequency electric current generated by dielectric equipment; employed with resin-bonded cores.

Diffusion - Movements of atoms within a solution. Net movement is usually from regions of high concentration to regions of low concentration to achieve homogeneity of the solution which may be a solid, gas, or liquid.

Dilatometer - Instrument for measuring expansion or contraction caused by changes in temperature or structure.

Dimensional stability - Ability of a casting to remain unchanged in size and shape under ordinary atmospheric conditions.

Direct-arc furnace - Electric furnace in which the material is heated directly by an arc established between the electrodes and the work.

Directional solidification - Refers to the arrangement of a solidification pattern in a casting by establishment of high temperature gradients, whereby solidification of the metal begins at the point farthest from the metal entrance or sprue and the metal progressively freezes or solidifies to and including the sprue.

Dirt - Indefinite term referring to any extraneous material entering a mold cavity and usually forming a blemish on the casting surface.

Dowel - A short pin of metal, wood, etc., used to join two pieces of material together.

Draft - Taper allowed on the vertical faces of a pattern to permit removal from the sand mold without excessive rapping and tearing of the mold walls.

Drag - The lower or bottom section of a mold or pattern.

Draw bar - A bar used for lifting the pattern from the mold. Also car connection.

Drawback - Section of a mold lifted away on a plate or arbor to facilitate removal of the pattern

Draw, surface - Appearance of shrink on the upper surface of a casting.

Drop out - Sand falling from the cope of a mold.

Dropping the bottom - Removal of the supporting props under the cupola bottom doors to permit emptying of the remaining contents.

Dross - Metal oxides, etc., on or in a metal or alloy.

Dry permeability - Property of a molded mass of sand dried at 221° to 230° F and cooled to room temperature, to permit passage of gases through it.

Dry-sand mold - A mold made of prepared molding sand dried thoroughly before being filled with metal.

Dry strength - Maximum strength of a sand mixture which has been dried at 105° to 110° C and cooled to room temperature for testing. Value may be in compression, shear, tensile, or transverse strength.

Ductile iron - Nodular or spheroidal graphite cast iron produced by residual magnesium remaining in the iron after ladle addition of magnesium.

Ductility - The property permitting permanent deformation by stress in tension with out rupture.

Duplexing - Term usually used in reference to melting metals or alloys in one type of furnace and transferring to another for holding, refining, etc. Common in the malleable field, where charges are melted in a cupola and transferred to air or electric furnaces for slight reduction of carbon and an increase in temperature.

Dye Penetrant - Penetrant is used to crack detection, which has a dye added to make it more readily visible under normal or black-lighting conditions. In the case of normal lighting, the dye is usually red and nonfluorescent. With black lighting, the dye is fluorescent and yellow-green in color.

- E -

Ejector marks - Marks left on die castings by the ejector pins, which may be raised or depressed from the surface of the casting.

Ejector pins - Pins used to eject die-castings from the die.

Ejector plate - Movable plate beneath a shell molding pattern containing the pins for lifting or ejecting the hardened, resin-bonded shell mold from the pattern.

Equilibrium - Dynamic condition of balance between atomic movements where the resultant is zero, a stable condition.

Erosion scab - Casting defect occurring where the metal has been agitated, boiled, or has partially eroded away the sand, leaving a solid mass of sand and metal at that particular spot.

Ethyl silicate - Light brown liquid consisting predominantly of tetraethyl silicate with some polysilicates which can be hydrolyzed with water to form alcohol and silicic acid. Used as a bonding agent in investment molding.

Eutectic - The alloy which has the lowest melting point possible for a given composition.

Eutectic reaction - Reaction in which a liquid solution solidifies or transforms at constant temperature to form a solid mass made up of two kinds of crystals.

Eutectoid - A solid solution of any series which cools without change to its temperature of final composition.

Exothermic reaction - A reaction which produces heat.

Expansion scabs - Rough thin layers of metal partially separated from the body of the casting by a thin layer of sand, and held in place by a thin vein of metal.

Expansion, sand - Dimensional increase that sand undergoes when subjected to elevated temperature conditions.

Expendable Pattern - In investment molding, the wax or plastic pattern that is left in the mold and later melted and burned out. Also called disposable pattern.

External chills - Various materials of high heat capacity such as metals, graphite, etc., forming parts of the walls of the mold cavity to promote rapid heat extraction from molten metal.

- F -

Facing - Refractory material applied to the face of a mold.

Facing sand - Specially prepared sand in the mold adjacent to the pattern to produce a smooth casting surface.

False cheek - A cheek used in making a three-part mold in a two-part mold.

Fatigue crack - A fracture starting from a nucleus where there is an abnormal concentration of cyclic stress, and propagating through the metal. Surface is smooth and frequently shows concentric markings with a nucleus as the center.

Feed head - A reservoir of molten metal provided to compensate for contraction of metal as it solidifies, by the feeding down of liquid metal to prevent voids. Also called a riser.

Ferric oxide - Red iron oxide, Fe_2O_3 , commonly available as hematite ore. Used in ground form in cores and molds to increase hot compressive strength.

Ferrite - Iron practically carbon-free. It forms a body-centered-cubic-lattice and may hold in solution considerable amounts of silicon, nickel, or phosphorus; hence the term is also applied to solid solutions in which alpha or delta iron is the solvent.

Ferroalloys - Alloys consisting of certain elements combined with iron, and used to increase the amount of such elements in ferrous metals and alloys. In some cases the ferroalloys may serve as deoxidizers.

Ferrophosphorus - An alloy of iron and phosphorus containing about 70% iron and 25% phosphorus.

Ferrostatic pressure - Pressure induced by a head of liquid iron or steel.

Fillet - A concave junction formed where two surfaces meet by use of a preformed strip of leather or wax

Filter - Just like it says, the filtering out of unwanted gases in the casting, at pouring off portion of making the casting.

Fin - A thin piece of metal projecting from a casting at the parting line or at the junction of cores, or of cores and mold, etc.

Fines - Sand grain sizes substantially smaller than the predominating grain sized in a molding sand; also material remaining on 200- and 270-mesh sieves and pan after tests for grain size and distribution.

Finish (machine) - Amount of metal allowed for machining.

Finish (verb) - The hand work on a mold after the pattern has been withdrawn.

Firebrick - Brick made of refractory clay or other material which resists high temperatures.

Fireclay - A type of clay which is resistant to high temperatures.

Flaring - Term used in connection with zinc-bearing alloys, particularly manganese bronze, to denote evolution of zinc oxide fumes during melting.

Flash - Thin fin or web of metal extending from the casting along the joint line as a result of poor contact between cope and drag molds.

Flask - Container in which a mold is made.

Flask pins - Assure proper alignment of cope and drag molds after the pattern is withdrawn.

Flask, slip - A removable flask which can be stripped vertically from the mold.

Flask, snap - A hinged flask which can be removed from the mold after completion.

Flask, tight - Flask which remains on the mold.

Flowability - Property of a foundry sand mixture which enables it to fill pattern recesses and move in any direction against pattern surfaces under pressure.

Fluidity - Ability of molten metal to flow readily; usually measured by the length of a standard spiral casting.

Fluorescent crack detection - Application of penetrating fluorescent liquid to a part, then removing the excess from the surface, which is then exposed to ultraviolet light. Cracks show up as fluorescent lines.

Flux - Any substance used to promote fusion. Also any material which reduces, oxidizes, or decomposes impurities so that they are carried off as slags or gases.

Founding - Art and science of melting and pouring metals and alloys into castings to serve mankind.

Free on Board (F.O.B.) - This is a historical transportation industry term. It deals with who pays the shipping charges on goods produced. The term is a pricing agreement which does not include the carriage charges, from the seller, to the buyer of a product. The seller absorbs the freight charges, the carriage charges, the destination charges, the shipping

charges, etc., whatever you wish to call the expense to move the material from the seller to the buyer. There may well be third party billing of these carriage charges. The seller may well have incorporated these charges in the selling price, but does not invoice the buyer for that fee. Remember...**"FREE ON BOARD,"** equates to a remembrance thought factor of ...**"FREE ONTO the BUYER"**...or F.O.B. as the early traffic managers so coined the term.

Freezing - Term used to denote the solidification process.

Furans - Generic term for a family of chemical compounds including furfural and furfuryl alcohol used as binders for core sands.

Fusion - Change from a solid to a fluid state caused by application of heat.

- G -

Gagger (jagger) - An L-shaped rod used for reinforcing sand in the cope mold.

Gamma iron - One of the allotropic (polymorphic) forms of iron which crystallizes in the face-centered-cubic lattice form. When pure, its range of stability is from 2552° to 1670° F.

Gas holes - Rounded cavities caused by generation or accumulation of gas or entrapped air in a casting; holes may be spherical, flattened or elongated.

Gate - Specifically, the point at which molten metal enters the casting cavity. Sometimes employed as a general term to indicate the entire assembly of connected columns and channels carrying the metal from the top of the mold to that part forming the casting cavity proper. Term also applied to pattern parts which form the passages, or to the metal that fills them.

Gated patterns - One or more patterns with gating systems attached.

Gilsonite - Natural black lustrous asphalt found in the Uinta Mountains in Utah and also known as uintaite. It is used as a carbonaceous addition to foundry sands.

Gooseneck - The pressure vessel or metal injection mechanism in a hot-chamber-type die-casting machine.

Grain fineness number - (See *AFS fineness number*.)

Grain refiner - Any material added to a liquid metal or alloy or treatment which produces a finer grain size in the subsequent solid.

Grains - Crystals in metals and alloys.

Granular pearlite - A structure formed from ordinary lamellar pearlite by long annealing at a temperature below but near to the critical point, causing the cementite to spheroidize in a ferrite matrix.

Graphite - Native carbon in hexagonal crystals, also foliated or granular massive, of black color with metallic luster, and soft. Used for crucibles, foundry facings, lubricants, etc. Also made artificially by passing alternating current through a mixture of petroleum coke and coal tar pitch.

Graphite, primary - Carbon precipitated as graphite flakes while the iron cools through the freezing eutectic in which austenite, graphite, molten iron, and carbide exist together. Usually with reference to white fracture cast iron.

Graphite, secondary - Graphite formed by decomposition of austenite during slow cooling of cast iron.

Graphitization - The decomposition of carbide to give free carbon as graphite or as temper carbon.

Graphitizer - Any substance, such as silicon, titanium, aluminum, etc., which promotes the formation of graphite in cast iron compositions.

Green permeability - Property of a molded mass of sand in its tempered condition which is a measure of its ability to permit the passage of gases through it.

Green sand - Prepared molding sand in the moist or as-mixed condition.

Green sand core Core used in the green state; not baked.

Green strength - Tenacity (compressive, shear, tensile, or transverse) of a tempered sand mixture.

Grinding - Removing gate stubs, fins, and other projections on castings by an abrasive wheel.

Growth - With reference to cast iron, permanent increase in volume that results from continued or repeated cyclic heating and cooling at elevated temperatures. For unalloyed iron, temperature is in excess of 900° F, and growth is caused by decomposition or graphitization of carbides and by oxidation of the graphite.

Guide pin - The pin used to locate the cope in the proper place on the drag.

Gypsum cement - Calcined calcium sulfate, commonly called plaster of Paris.

- H -

Hand ladle or shank - A small ladle carried by one man.

Hard sand match (match plate) - A body of sand shaped to conform to the parting line upon which a pattern is laid in starting to make a mold. Sand is made hard by addition of linseed oil and litharge, Portland cement, etc. (*See Match.*)

Head - Pressure exerted by a fluid such as molten metal. Also used as a term for a riser.

Heap sand - Sand in piles on the foundry floor.

Hearth - That portion of a reverberatory furnace on which the molten metal or bath rests.

Heat - A stated tonnage of metal obtained from a period of continuous melting in a cupola or other furnace.

Heat transfer - Transmission of heat from one body to another by radiation, convection, or conduction.

Holding furnace - Usually a small furnace for maintaining molten metal at the proper pouring temperature, and which is supplied from a large melting unit.

Holding ladle - Heavily lined and insulated ladle in which molten metal is placed until it can be used. (*See Holding furnace.*)

Horn gate - Curved gate in the shape of a horn arranged to permit entry of molten metal at the bottom of the casting cavity.

Hot deformation (sand) - Change of form of a sand specimen which accompanies the determination of hot strength.

Hot shortness - Brittleness in metal at elevated temperature.

Hot spots - Term applied to gray iron castings to denote chilled areas or inclusions that are harder than the surrounding iron and that cause machining difficulties.

Hot strength (sand) - Tenacity (compressive, shear, tensile, or transverse) of a sand mixture determined at an elevated temperature.

Hot tears - Cracks in castings formed at elevated temperatures; usually by contraction stresses.

Hypereutectic alloy - An alloy containing more than the eutectic amounts of the solutes.
Analogous to hypereutectoid.

Hypereutectoid - An alloy containing more than the eutectic composition.

Hypoeutectoid - An alloy containing less than the eutectoid composition.

- I -

Impregnation - A process for salvaging leaky castings by injecting under pressure liquid synthetic resins, tung oil, etc., into the porous area. This material is then solidified in place by heating or baking.

Impression - Cavity in a die-casting die or in a mold.

Inclusions - Particles of slag, sand, or other impurities such as oxides, sulfides, silicates, etc., trapped mechanically during solidification or formed by subsequent reaction of the solid metal.

Indirect-arc furnace - Electric furnace in which the arc is struck between two horizontal electrodes, heating the metal charge by radiation.

Induction furnace - A melting unit wherein the metal charge is melted electrically by induction.

Ingot - Commercial pig mold or block in which copper, copper-base, aluminum, aluminum alloys, magnesium, magnesium alloys, and other nonferrous materials are made available to the foundry man.

Injection - Forcing molten metal into a die-casting die. Also refers to forcing oxygen, nitrogen, and other gases, as well as solids such as calcium carbide and graphite, into molten metal.

Inoculation - A process of adding some material to molten metal in the ladle for the purpose of controlling the structure to an extent not possible by control of chemical analysis and other normal variables.

Insulating sleeve - Hollow cylinders or sleeves formed of gypsum, diatomaceous earth, pearlite, vermiculite, etc. Placed in the mold at sprue and riser locations to decrease heat loss and rate of solidification of the metal contained in them.

Internal chills - Solid pieces of metal or alloy, similar in composition to the casting, placed in the mold prior to filling it with molten metal. They increase the rate of solidification in their areas and are employed only where feeding is difficult or impossible.

Internal shrinkage - Void or interconnected voids appearing in the interior of a casting; caused by improper or insufficient feeding during the solidification process.

Internal stress - A system of balanced forces existing within a casting not subjected to a working load.

Inverse chill - A condition in an iron casting section in which the interior is mottled or white while the outer sections are gray. Also called reverse chill, internal chill, or inverted chill.

Investment molding - Method of molding using a pattern of wax, plastic, or other material which is "invested" or surrounded by a molding medium in slurry or liquid form. After the molding medium has solidified, the pattern is removed by subjecting the mold to heat, leaving a cavity for reception of molten metal. Also called lost-wax process or precision molding.

Iron, malleable - A mixture of iron and carbon, including smaller amounts of silicon, manganese, phosphorus, and sulfur, converted structurally by heat treatment into a matrix of ferrite containing nodule of temper carbon.

Iron, white or hard - Iron of suitable composition in which the castings, later to be malleableized, are originally cast. Carbon is in the combined form; hence it's white fracture and name.

- J -

Jacket, mold - A wood or metal form slipped over a mold made in a snap or slip flask, to support the four sides of the mold during pouring. Jackets and mold weights are shifted from one row of molds to another during the pouring period.

Jobbing Foundry - Foundry which is not a part of a manufacturing plant, and produces castings for sale. Usually makes a wide variety of castings in small lots or quantities.

Jolt machine - Molding machine which packs or rams the sand around the pattern by raising the table on which the flask, sand, and pattern are mounted a few inches and allowing the whole to drop suddenly. The table is raised pneumatically, and the operation is repeated until the desired sand density is reached.

Jolt squeeze machine - Combination molding machine on which the sand is rammed into the flask by jolting (*see Jolt machine*), then compressed further by a mechanism that uses fluid pressure to force the table and contained flask upward against a fixed plate. The plate is slightly smaller in dimension so that it fits inside the flask.

- K -

Kaolinite - Hydrated silicate of alumina represented by the formula $\text{Al}_2\text{O}_3 \cdot 2 \text{SiO}_2 \cdot 2\text{H}_2\text{O}$. It is a white, pearly mineral, crystallizing in a monoclinic system in the form of small, hexagonal plates. Constituent of kaolin, white china clay, used for porcelain, etc.

Killed steel - Molten steel held in a ladle, furnace, or crucible (and usually treated with aluminum, silicon, or manganese) until more gas is evolved and the metal is perfectly quiet.

Kish - Graphite thrown out by liquid cast iron in cooling.

Knock out - To remove sand and casting from a flask. -

Knock-out pins - Small pins on die-casting machines, permanent molds, and shell-molding machined for ejection of castings, etc. (*See Ejector pins.*)

- L -

Ladle - Metal receptacle lined with refractory for transportation of molten metal. Types include hand, bull, sulky, trolley, crane, bottom-pour, and teapot.

Ladle, bull - Large ladle for transporting and pouring molten metal.

Lance, oxygen - Long steel pipe or tube, usually covered with refractory, used to inject oxygen into molten steel to reduce the carbon content. Also may be used to open up frozen tap holes in cupolas, etc.

Leaker - Foundry term for castings which leak under liquid or gaseous pressure.

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

Linseed oil - Drying-type oil expressed from flax seeds and used as a binder for core sand.

Liquid contraction - Shrinkage or contraction in molten metal as it cools from one temperature to another while in the liquid state.

Liquidus - The temperature at which solidification of metal begins on cooling and the temperature at which the last portion of solid metal becomes liquid on heating.

Loam - A coarse, strongly bonded molding sand used for loam and dry-sand molding.

Loam molding - A system of molding, especially for large castings, wherein the supporting structure is constructed of brick. Coatings of loam are applied to form the mold face.

Loose piece - Part of a pattern so attached that it remains in the mold, and is removed after the body of the pattern is drawn. In die-casting, a type of core (which forms undercuts) positioned in, but not fastened to, a die and so arranged as to be ejected with the die-casting, from which it is removed and used repeatedly for the same purpose.

- M -

Machinability - The capability of being cut, turned, broached, etc., by machine tools.

Magnaflux - Trade name for a method of magnetic crack detection.

Magnaglo - Trade name for a method of magnetic crack detection in which the magnetic particles are treated so that they fluoresce in ultraviolet light.

Magnetic crack detection - Method of locating cracks in materials which can be magnetized; done by applying magnetizing force and applying finely divided iron powder which then collects in the region of the crack.

Malleability - The property of being permanently deformed by compression without rupture.

Malleableization - Annealing or heat-treating operation performed on white iron castings to transform the combined carbon into temper carbon.

Manganese - One of the elements; its chemical symbol is Mn. It's formula weight is 54.93; specific gravity 7.2, and melting point is 1260° C. Metallic manganese is used in the nonferrous industry both as a deoxidizing agent and as an essential constituent to improve physical properties of certain alloys.

Manganese briquets - Crushed ferromanganese bonded with a special refractory in briquet form, and containing 2-lb metallic manganese and ½-lb metallic silicon.

Master pattern - The pattern from which the working pattern is cast.

Match - A form of wood, plaster of Paris, sand or other material on which an irregular pattern is laid or supported while the drag is being rammed.

Matchplate - A metal or other plate on which patterns split along the parting line are mounted back to back with the gating system to form an integral piece.

Melting pot - Metal, graphite-clay, or ceramic vessel in which metal is melted.

Melting range - Pure metals melt at one definite temperature, but constituents of alloys melt at different temperatures, and the variation from the lowest to the highest is called the melting range.

Melting rate - Amount of metal melted in a given period of time, usually one hour.

Melting zone - Portion of the cupola above the tuyeres in which the metal melts.

Metal penetration - Defect in the casting surface which appears as if the metal has filled the voids between the sand grains without displacing them.

Metallurgy - Science dealing with the constitution, structure, and properties of metals and alloys, and the processes by which they are obtained from ore and adapted to the use of man.

Microporosity - Extremely fine porosity in castings caused by shrinkage or gas evolution and apparent on radiographic film as mottling.

Microradiography - Process of passing x-rays through a thin section of an alloy in contact with photographic film, and then magnifying the radiograph 50 to 100 diameters to observe the distribution of alloying constituents, of voids, and of other microstructural features.

Microstructure - The structure and characteristic condition of metals as revealed on a ground and polished (etched or unetched) specimen at magnifications above 10 diameters.

Mischmetal - Alloy of rare-earth metals containing about 50% cerium and 50% lanthanum, neodymium, and similar elements.

Misrun - A casting not fully formed.

Mold - The form, usually of sand, containing the cavity into which molten metal is poured to make the casting.

Mold cavity - Impression left in the sand mold by the pattern.

Mold clamps - Devices used to lock or hold cope and drag together.

Mold conveyor - Power-driven unit on which molds are conveyed from the molding station to pouring station to shakeout.

Mold hardener - In sand molds in which sodium silicate is the binder, injection of CO₂ causes a chemical reaction which results in a rigid structure.

Mold oven - Oven or furnace in which molds are dried.

Mold shift - Casting defect resulting when the two cavities in the cope and drag molds do not match properly.

Mold wash - Usually an aqueous emulsion, containing various organic or inorganic compounds or both, which is used to coat the face of a mold cavity. Materials include graphite, silica flour, etc.

Mold weights - Weights placed on top of molds to offset internal or ferrostatic pressure.

Molding machine - Hand or pneumatically operated machine on which molds are made and which rams the sand by squeezing or jolting or both.

Molding Sand - Mixture of sand and clay suitable for mold making.

Molding bench - The making of sand molds from loose or production patterns at a bench.

Molding floor - Making sand molds from loose or production patterns at a floor. Patterns are usually too large to be handled satisfactorily on the bench.

Molding, machine - Making sand molds from production patterns on molding machines.

Molly - You found me!! All my Love, Dad !

Mottled - White iron structure interspersed with spots or flecks of gray.

Muller - Type of foundry-sand-mixing machine.

Multiple-cavity die - A die-casting die having more than one impression of the same part. (See *Combination die*.)

Multiple mold - Composite mold made up of stacked sections. Each section produces a complete gate of castings. All castings are poured from a central downgate.

- N -

Nail, chill - Steel nail with a heavy head which is inserted in the mold wall to hasten cooling of the metal at that point.

Natural sand - Generic term used to describe claybonded sands, suitable for molding operations to produce castings; widely distributed except for the Western section of the U.S.

Nickel - One of the elements; its chemical symbol is Ni. Its formula weight is 58.69; specific gravity 8.90, and melting point 1452° C.

Nodular graphite - Graphite or carbon in the form of spheroids.

Nodular iron - Cast iron which has the major part of its graphitic carbon in nodular form. (See *Ductile iron*.)

Nucleation - Initiation of a phase transformation at discrete sites; the new phase grows on nuclei. (See *Nucleus*.)

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 -

Oil core - A core bonded with oil.

Oil furnace - Furnaces fired with oil

Olivine - Magnesium-iron-orthosilicate composed of forsterite and fayalite. Does not contain free silica. Possible molding material.

One piece pattern - Solid pattern.

Open-hearth furnace - A refractory –lined, shallow-bath, rectangular furnace in which both hearth and charge are subjected to the direct action of the fuel flame. Fuel may be producer gas, coke-oven gas, powdered coal, or oil. Flame is created by mixing preheated air with fuel in ports. Air is preheated in regenerators called checker chambers.

Open-hearth steel - Steel made in open-heart furnace.

Open riser - A riser open to the atmosphere. Compare with blind riser.

Open sand casting - A casting poured into a mold which has no cope or other 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.

Overflow well - A recess in a die-casting die connected to the die cavity and functioning as a vent.

Oxidation - Any reaction whereby an element reacts with oxygen.

Oxidizing flame - A flame produced with excess oxygen.

- P -

Pad (padding) - Metal added deliberately to the cross section of a casting wall, usually extending from a riser, to ensure adequate feeding to a localized area in which a shrink might occur without the addition.

Parting - A dividing line at which sections of a mold are separated.

Parting compound - Material dusted or sprayed on a pattern or mold to prevent adherence of sand.

Parting line - The line along which a pattern is divided for molding, or along which the sections of a mold or die separate.

Pattern - Model of wood, metal, plaster, or other material used in making a mold.

Pattern coating - Coating material applied to wood patterns to protect them against moisture and abrasion of molding sand.

Pattern letters - Metal or plastic letters or figures in various sizes which are affixed to patterns for identification purposes.

Pattern, split - Pattern usually made in two parts, sometimes in more than two.

Patternmaker's shrinkage - Shrinkage allowance made on all patterns to compensate for the change in dimensions as the solidified casting cools in the mold from freezing temperature of the metal to room temperature. Pattern is made larger by the amount of shrinkage characteristic of the particular metal in the casting and the amount of hindered contraction to be encountered. Rules or scales are available for use.

Pearlite - A microconstituent of iron and steel consisting of alternative layers of ferrite and iron carbide or cementite.

Pearlitic malleable iron - Irons made from the same or similar chemical compositions as regular malleable iron, but so alloyed or heat treated that some of the carbon in the resultant material is in the combined form.

Peen - Small end of a molder's hammer.

Pencil core - Small cylindrical core used with Williams or atmospheric riser (*see which*).

Permanent mold - A long-life mold into which metal is poured by gravity.

Permeability - The property in sand molds which permits the passage of gases. Magnetic permeability of a substance is the ratio of the magnetic induction of the substance to the magnetizing field to which it is subjected.

pH - The negative logarithm of the hydrogen ion activity. It denotes the degree of acidity or basicity of a solution. At 25° C, the neutral value is 7. Acidity increases with decreasing values below 7, and basicity increases with increasing values above 7.

Phase - A constituent which is completely homogeneous, and is both physically and chemically separated from the rest of the alloy by definite bounding surfaces; for example, austenite, ferrite, cementite. Not all constituents are phases; pearlite for example.

Phase diagram - Graphical representation of the equilibrium temperatures and the composition limits of phase fields and phase reactions in an alloy system.

Phosphorus - One of the elements; its chemical symbol is P. Its formula weight is 123.92; specific gravity 1.82, and melting point 44.1° C.

Pig iron - Product of the blast furnace by the reduction of iron ore. Also the overiron in the foundry poured into pig molds.

Pilot casting - Usually the first casting made from a production pattern and examined for dimensional accuracy, quality, and other features before the pattern is placed on the line.

Pinhole - Small hole under the surface of a casting.

Pins, flask - Hardened steel locating pins used on flasks to ensure proper register of cope and drag molds.

Pipe - Cavity formed by contraction in metal during solidification of the last portion of liquid metal, as in a riser.

Piqua - A city in Ohio, located near Dayton, Ohio; all of which is not too far from Dana's.

Pit mold - Mold in which the lower portions are made in a suitable pit or excavation in a foundry floor.

Pitch - Usually coal-tar pitch obtained in manufacture of coke and distilled off at about 350° F. Used as a binder in large cores and molds. Melting range is 285 to 315° F.

Plaster molding - Molding method wherein gypsum or plaster of Paris is mixed with fibrous talc, with or without sand, and with water to form a slurry that is poured around a pattern. In a short period of time, the mass air-sets or hardens sufficiently to permit removal of the pattern. The mold so formed is baked at elevated temperature to remove all moisture prior to use. One variation is the Antioch process.

Plastic pattern - Pattern made from any of the several thermosetting-type synthetic resins such as phenol formaldehyde, epoxy, etc. Small patterns may be cast solid, but large ones are usually produced by laminating with glass cloth.

Plates, bottom - Plates, usually of metal, on which molds are set for pouring.

Plates, core drying - Straight, flat plates of metal or heat-resisting composition on which cores are placed for baking.

Pneumatic tools - Grinders, rammers, drills, etc., operated by compressed air.

Porosity - Unsoundness in castings appearing as blowholes and shrinkage cavities.

Pot - Term usually applied to cast iron containers used in melting aluminum-base alloys; also used to describe steel crucibles for melting magnesium-base alloys, as well as graphite crucibles.

Pour - Discharge of molten metal from the ladle into the mold.

Pouring off - The task of ladling, or mechanically pouring, of the molten metal into the molds, forming the casting.

Poured short - Casting which lacks completeness due to the cavity not being filled with molten metal.

Pouring basin - Reservoir on top of the mold to receive the molten metal.

Pouring cup - Article made of sand or ceramics containing a cup-shaped depression which is placed over a sprue opening and acts as a funnel to receive the metal poured from the ladle. (See *Pouring basin*.)

Pouring device - Mechanically operated device with a ladle set for controlling the pouring operation.

Pouring ladle - Ladle used to pour metal into the mold.

Powdered coal - Finely ground, high-volatile coal used for heating furnaces and annealing ovens in the malleable foundry industry.

Preheating - General term for a heating which is applied to preliminary to some further thermal or mechanical treatment.

Print back - After the surface of a mold is dusted with graphite facing, the pattern is replaced, rapped into position and again removed.

Production foundry - Highly mechanized foundry for manufacturing large quantities of repetitive castings.

Progressive solidification - (See *Directional solidification*.)

Purifiers, flux - Various materials added to molten metals and alloys for the purpose of removing impurities, gases, etc.

Push-up - An indentation in the casting surface due to displacement (expansion) of the sand in the mold.

Pyrometer - An instrument for determining elevated temperatures.

- Q -

No - Q - WORDS

- R -

Radiographic inspection - Examination of the soundness of a casting by study of radiographs taken in various areas or of the whole casting.

Radiographic testing - Use of x-or gamma rays in studying the internal structure of objects to determine their homogeneity.

Ram - To pack the sand in a mold.

Ram-up core - (See *Core, ram-up.*)

Rammer - Tool for ramming the sand.

Rapping bar - A pointed bar (or rod) made of steel or other metal, which is inserted vertically into a hole in a pattern, or driven into it, then struck with a hammer on alternate sides to cause vibration and loosening of the pattern from the sand.

Rapping plate - Metal plate attached to a pattern to permit rapping for removal from the sand.

Rat tail - Minor sand buckle occurring as a small irregular line or series of lines.

Rebonding - Term usually employed in reference to adding new bonding material to used molding sand so that it can be used again to produce molds.

Reducing flame - Flame burning with insufficient oxygen to provide complete combustion, resulting in the presence of carbon in the flame.

Refractory - Material usually made of ceramics, which is resistant to high temperatures, molten metal, and slag attack.

Relief sprue - The term usually refers to a second sprue at opposite end of the runner to relieve pressure created during pouring operation.

Resin binder - Any of the thermosetting types of resins used as binders for producing cores and shell molds, such as phenol and urea formaldehydes, melamines, furans (furfuryls and furfuryl alcohol), etc.

Resin-coated sand - Molding or core sand in which the binder is resin applied to the sand as a coating by either cold or hot coating.

Reverberatory furnace - Melting unit with a roof arranged to deflect the flame and heat toward the hearth on which the metal to be melted rests.

Riddle - Hand- or power-operated device for removing large particles of sand or foreign material from foundry sand.

Rigging - Equipment used for making a mold.

Riser - Reservoir of molten metal attached to the casting to compensate for internal contraction of the casting during solidification.

Riser gating - Gating system in which molten metal from the sprue enters a riser close to the mold cavity and then flows into the mold cavity.

Rockwell hardness testing - Method of determining the indentation hardness by measuring the depth of residual penetration by a steel ball or a diamond cone.

Rocky - Man's best friend, this one knows no fear, he has no boundary, he likes a lick, as a bee likes to buzz, he barks at whatever he thought it was ...

Rolling over - Operation of reversing the position of the mold so that the pattern faces upward in order to be removed.

Rollover board - Wood or metal plate on which the pattern is laid face down for ramming of the mold.

Rollover machine - Molding machine on which the mold is rolled over before the pattern is drawn.

Run-out - Metal flowing through a defect in the mold.

Runner - The portion of the gate assembly which connects the downgate or sprue with the casting.

- S -

SG iron - Term used in Britain and continental Europe for ductile or nodular iron. SG means spherulitic or spheroidal graphite.

Sag - Defect which appears as an increase or decrease in metal section due to sinking of sand in the cope (decreased section) or sagging in the core (increased section).

Sand blast - Sand driven by a blast of compressed air (or steam). It is used to clean castings, to cut, polish, or decorate glass or other hard substances, and also to clean building fronts, etc.

Sand castings - Metal castings produced in sand molds.

Sand conditioning - Preparation of used molding sand for reuse, which includes additions of bond, additives, moisture, etc.

Sand control - Procedure used to adjust various properties of sand such as fineness, permeability, green strength, moisture content, etc., in order to obtain castings free from such defects as blows, scabs, rat tails, veins, etc.

Sand control equipment - Testing instruments such as moisture determinators, permeability air-flow apparatus, etc., for determining the various physical properties of sands.

Sand dryer - Apparatus for removing moisture from sand.

Sand holes - Cavities of irregular shape and size whose inner surfaces plainly show the imprint of granular material.

Sand muller - A machine for mixing sand by kneading and squeezing.

Sand reclaimer - Equipment for removing extraneous material from used sand and reconditioning it for further use.

Sand slinger - Molding machine which throws sand into a flask or corebox, by centrifugal action.

Sand tempering - Adding sufficient moisture to core or molding sand to make it workable.

Sand toughness - Indication of molding sand workability, particularly with reference to ramability, because the tougher the sand, the harder it is to ram tightly against the pattern. It is usually given as a number obtained by multiplying deformation by green compressive strength times 1000.

Sand, backing - Sand in a mold back of the facing.

Sand, bank - Sand from a bank or pit

Sand, blast - Sand used in an abrasive blasting machine for cleaning castings.

Sand, core - Sand used in making cores

Sand, facing - Prepared sand used next to the pattern.

Sand, floor - Sand used in floor molding.

Sand, heap - Sand prepared on foundry floor.

Sand, lake - Sharp sand from vicinity of lakes.

Sand, molding - Sand used to make molds.

Sand, natural - Naturally bonded sand as distinguished from that which is formed synthetically.

Sand, open - Sand through which gases can pass freely.

Sand, silica - Sand composed of almost pure silica.

Sand, synthetic - Molding sand prepared by adding clay or other bond to the sand which is practically free of those materials.

Scab - A blemish on a casting caused by eruption of gas from the mold face.

Sea coal - Finely ground bituminous coal.

Seam - Surface defect on a casting similar to a cold shut, but not as severe.

Segregation - 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.

Shakeout - The operation of removing castings from the mold.

Shakeout machinery - Equipment for mechanical removal of castings from molds.

Shank - The handle attached to a small ladle.

Sharp sand - Sand that is substantially free of bond; the term does not refer to grain shape.

Shear strength - Maximum shear stress which a material can develop.

Shell molding (corning process) - Process in which clay-free silica sand coated with the thermosetting resin or mixed with the resin is placed on a heated metal pattern for a short period of time to form a partially hardened shell. The unaffected sand mixture is removed for further use. The pattern and the shell are then heated further to harden or polymerize the resin-sand mix, and the shell is removed from the pattern.

Shift - A casting defect resulting from a mismatch of cope and drag. Sometimes there is a Core Shift, which also produces defective casting.

Shot - Abrasive blast cleaning material. In die-casting, it is the phase of the die-casting cycle when molten metal is forced into the die.

Shrink hole - A hole or cavity in a casting resulting from the contraction and insufficient feed metal, and formed during the time the metal changed from the liquid to the solid state.

Shrink rule - Patternmaker's rule graded to allow for metal contraction.

Shrinkage, centerline - Shrinkage occurring in the center of casting sections, particularly with platelike or barlike contours, which solidify simultaneously from two faces and cut off feeding in the central portion.

Sieve - A device with meshes of wire or other material for separating fine material from coarse material.

Silica - Silicon dioxide, SiO_2 , occurring in nature as quartz, opal, etc. Molding and core sands are impure silica.

Silica flour - Silica in finely divided form.

Silica wash - Silica flour mixed with water and other materials to form a brushable or sprayable facing material.

Silicon - One of the elements with the chemical symbol Si whose formula weight is 28.06, specific gravity 2.4, and melting point 1420°C .

Silicon-aluminum - An alloy of 50% silicon and 50% aluminum used for making silicon additions to aluminum alloys; also called an intermediate or hardener alloy. Melting point is 1070°F .

Silicon brass - A series of alloys containing 0.5-6% silicon, 1-19% zinc and a substantial amount of copper.

Silicon bronze - A series of alloys containing 1-5% silicon, 0.5-3% iron, under 5% zinc, under 1.5% manganese, and the remainder being substantially copper.

Silicon carbide briquets - Silicon carbide in briquet form used as an inoculant and deoxidizer in cupola-melted gray iron.

Silicon-copper - An alloy of silicon and copper, used as a deoxidizer and hardener in copper-base alloys, which is available in tow types containing 10 and 20% silicon

Silvery iron - A type of pig iron containing 8-14% silicon, 1.50% carbon max., 0.06% sulfur max., and 0.15% phosphorus max.

Sintering point - The temperature ate which a molding material begins to adhere to a casting, or, in a test, the point when the sand coheres to a heated platinum ribbon under controlled conditions.

Skeleton pattern - A pattern made in outline to reduce cost.

Skim bob - Small upward bulge in the grating system, near the casting cavity, which functions as a dirt trap.

Skim core - Flat core or tile placed in a runner system to skim the flowing stream of metal. In a pouring basin, it holds back the slag and dross, permitting clean metal to pass underneath.

Skim gate - An arrangement which changes the direction of flow of molten metal in the gating system and thereby prevents the passage of slag and other extraneous materials beyond that point.

Skimmer - A device or tool for removing slag and dross from the surface of molten metal.

Skin - The surface of a mold or casting.

Skin drying - Drying of the mold surface by direct application of heat.

Slag - A nonmetallic covering on molten metal as the result of the combining of impurities contained in the original charge, such as ash from the fuel, and any silica and clay eroded from the refractory lining. Except in bottom pour ladles, it is skimmed off prior to pouring the metal.

Slurry - Thin watery mixture such as the gypsum mixture for plaster molding, the molding medium used in investment molding, core dips, and mold washes.

Slush casting - Casting made by pouring an alloy into a metal mold, allowing it to remain sufficiently long to form a think solid shell, and then pouring out the remaining liquid metal.

Smelter - An individual or firm which wins metals from cores, or which melts, treats or refines scrap metals an alloys for further use.

Snag - Removal of fins and rough places on a casting by means of grinding.

Soldiers - Thin pieces of wood used to strengthen a body of sand or hold it in place.

Solid contraction - Shrinkage or contraction as a metal cools from the solidifying temperature to room temperature.

Solid solution - A single solid homogeneous crystalline phase containing two or more chemical species.

Solidification - Process of metal (or alloy) changing from the liquid to the solid state.

Solidification range - Only pure metals solidify or freeze at one definite temperature. Alloys contain different constituents which solidify at different temperatures, and the various temperatures from that of the first constituent to solidify to that of the last to constituent to freeze is called the solidification range.

Solidifying contraction - Shrinkage or contraction as metal solidifies.

Solidus - Temperature at which freezing is completed. Below that temperature all metals are completely solid.

Spect-o-graph - Optical instrument for determining the concentration of metallic constituents in a metal (or alloy) by the intensity of specific wave lengths generated when the metal or alloy is thermally or electrically excited.

Spiegeleisen (spiegel) - A high manganese pig iron containing 15-30% manganese and used in bessemer and open-hearth steel production.

Sprue - The vertical portion of the gating system where the molten metal first enters the mold. In die-casting, the metal that fills the conical passage (sprue hole) connecting the nozzle with runners.

Sprue base - The lower end of the sprue attached to the runner system. It is usually in the form of an enlargement or reservoir to reduce turbulence.

Sprue button - A device attached to the cope pattern to indicate where the sprue should be cut.

Sprue cutter - A piece of tubing which cuts the sprue hole through the cope. Also a shear-type machine for removing the sprue and gates from the casting.

Sprue pin - In die-casting, a tapered pin with a rounded end projecting into a sprue hole, acting as a core that deflects the metal and aids in removal of the sprue from the die-casting.

Sprue plug - A tapered metal or wood pin used to form the sprue opening in a mold. Also a metal or other stopper used in pouring basin to prevent molten metal from flowing into the sprue until a certain level has been reached. It prevents entry of dirt and dross.

Spruing - Removing gates and risers from castings after the metal has solidified.

Squeeze pressure - The pressure applied by a molding machine to press the flask and contained sand against the fixed squeeze head or board on a molding machine.

Stack Molding - Molding method in which the half-mold forms the cope and drag. They are placed one on top of the other and poured through a common sprue. Cavities on the bottom side of one half-mold rest on the flat side of the half-mold beneath. When the cavities are in both sides of the half-molds, the method is called multiple molding.

Step gate - A vertical sprue containing a number of side branches or entries at different levels into the casting cavity.

Stop off - To shorten or change a mold.

Stop off strip - Reinforcing members on frail patterns. Impressions later filled with sand.

Strained castings - Molten metal, when poured into the mold too fast, raises the cope slightly from the drag and produces an oversize casting with protruding fins; an oversize casting can also be produced from a weak mold.

Strainer core - A perforated core placed at the bottom of a sprue or in other locations in the gating system to control the flow of the molten metal. To some extent, it prevents coarse particles of slag and dross from entering the mold cavity.

Strains, casting - Strains produced by internal stresses, resulting from unequal contraction of the metal as the casting cools.

Strike off - A straight edge to cut the sand level with the top of the drag or cope flask.

Stripping machine - A device for removing the pattern from a mold or a core from the core box.

Sulfur - A chemical element having symbol S, formula weight 32.06, specific gravity 2.046, and melting point 120° C.

Supercooling (undercooling) - Cooling below the temperature at which an equilibrium phase transformation can take place without actually obtaining the transformation.

Superheating - Theoretically, the temperature above the liquidus; in practice, it usually means temperature above the usual pouring range.

***Surface finish* - Condition or appearance of the surface of a casting.**

***Sweep* - To form a mold or core by scraping the sand with a form sweep having the desired profile.**

***Synthetic sand* - Any sand compounded from selected individual materials which, when mixed together, produce a mixture of proper physical properties from which to make molds**

- T -

***Tap* - To withdraw a molten charge from the melting unit.**

***Tap hole* - Opening in a furnace through which molten metal is tapped into the forehearth or ladle.**

***Teapot ladle* - Ladle with external spout wherein the molten metal is poured from the bottom rather than from the top.**

***Tear, hot* - Same meaning as hot crack, but developing before the casting has solidified completely.**

***Temper carbon* - Carbon in nodular form, characteristic of malleable iron.**

***Tempering (sand)* - Addition of water to and mixing molding sand to obtain uniform distribution of moisture.**

***Tensile strength* - The greatest load per square inch of original cross-sectional area carried during a tension test.**

***Ternary alloy* - One which contains three principal elements.**

***Thermal contraction* - Decrease in linear dimensions of a material which accompanies a change in temperature.**

***Thermit reaction* - Exothermic, self-propagating processes in which finely divided aluminum powder is used to reduce metal oxides to free metals by direct oxidation of aluminum to aluminum oxide, with accompanying reduction of the less stable metal oxide.**

***Thermocouple* - A bimetallic device capable of producing an electromotive force roughly proportional to temperature differences on its hot and cold junction ends and used in the measurement of elevated temperatures.**

***Tin* - A chemical element having symbol Sn, formula weight 118.70, specific gravity 7.31, and melting point 231.85° C.**

***Tin sweat* - Beads or exudations of a tin-rich low-melting phase found on the surface of or on risers of bronze castings, which are usually caused from absorption of hydrogen by the molten metal.**

***Tongs* - Metal instrument with two legs joined by a hinger for grasping and holding things, e.g., crucible tongs.**

Top board - A wood board on the cope half of the mold to permit squeezing the mold.

Transfer ladle - Container used to carry molten metal from the melting furnace to holding furnace, or from the furnace to pouring ladles.

Trim die - Die for shearing (or shaving) flash from a die-casting.

Trimming - Removing fins, gates, etc. from castings.

Trowel - Tool for sleeking, patching, and finishing a mold.

Tucking - Pressing sand with the fingers under the flask bars, around gagers, and other places to ensure firm placement.

Tumbling barrel - A revolving metal, wood box, or barrel in which castings are cleaned.

Tuyere - Opening through which the air blast enters the cupola.

- U -

Ultrasonic testing - Use of elastic waves of the same nature as sound, but of shorter wave length and higher frequency than those that affect the human ear (0.5-5 million cycles per sec), for detecting flaws in materials.

Undercut - Part of a mold or die requiring a drawback. (*See Drawback.*)

- V -

V-Process - a casting technique, see the Education Section, under Casting and Molding Processes for the explanation.

Vacuum degassing - Subjecting molten metal to a vacuum to remove deleterious gases such as hydrogen, oxygen, and nitrogen.

Vacuum melting - Melting, usually by induction heating, in a closed container which is subjected to a vacuum.

Vacuum refining - Vacuum melting to remove gaseous metal contaminants.

Veining - Surface defect on castings appearing as veins or wrinkles, which results from cracks in the sand due to elevated temperature conditions and occurs mostly in cores.

Vent - An opening in a mold or core to permit escape of steam and gases; it is also called a vent hole.

Vent rod - A piece of wire or bar to form the vents in the sand.

Vent wax - Wax in rod shape placed in the core during manufacture. In the oven the wax is melted out, leaving a vent or passage.

Vibrator - A device which jars or vibrates the pattern (or match plate) as it is withdrawn from the sand.

Viscosity - Resistance of a fluid substance to flowing. A measurable characteristic for an individual substance at a given temperature and under definite conditions.

- W -

Wash - Casting defect resulting from erosion of sand by flowing metal. Also a term for coating materials applied to molds, cores, etc.

Wax - Class of substances of plant, animal, or mineral origin, insoluble in water, partly soluble in alcohol, ether, etc., and miscible in all proportions with oils and fats. They consist of esters, free fatty acids, free alcohols, and higher hydrocarbons. Common waxes are beeswax, bayberry, paraffin wax, ozokerite, ceresin, and carnauba. Their mixtures are formed into rods and sheets and used for forming vents in cores and molds, repairing patterns, etc.

Weak sand - Sand lacking in the proper amount of bond.

Well (cupola) - Lower portion of a cupola, between the sand bottom and the slag hole, which forms a reservoir for the molten metal.

Wetting agent - Surface-active agent which by reducing surface tension of the wetting liquid causes a material to be wetted more easily.

Whirl gate - Gating system in which the metal enters a circular reservoir at a tangent, and so whirls around, leaving dirt and slag behind before passing into the mold cavity.

Whistlers - Small openings from isolated mold cavities to allow gases to escape easily. (*See Vent.*)

White cast iron - Cast iron in which substantially all the carbon is present in the form of iron carbide, and which has a white fracture.

Wood flour - Finely ground wood, usually hardwood, low in resin.

- X -

***X-ray* - Form of radiant energy with extremely short wave length which has the ability to penetrate materials that absorb or reflect ordinary light; a NDT Process**

***Xavier* - A university in Cincinnati, Ohio.**

- Y -

***Yield* - In production of castings, a value expressed as a percentage indicating the relationship of the weight of a casting to the total composite of the casting and its gating system. For example, if the casting and gating system weigh 125 lb. and the casting weighs 100 lb., the yield is 80%.**

- Z -

Zinc - A chemical element having symbol Zn, formula weigh 65.38, specific gravity 7.140, and melting point 419.4° C.

Zircon - Natural zirconium silicate, $ZrSiO_4$ containing 67.23% zirconium oxide, ZrO_2 , and 32.77% silica, SiO_2 , is used as a molding medium.

- # -

319 - a grade of Aluminum

356 - a grade of Aluminum

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