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भारतीय मानक

ढलाई प्रौद्योगिकी से संबंधित पारिभाषिक शब्दावली

(पहला पुनरीक्षण)

Indian Standard

GLOSSARY OF TERMS RELATING TO FOUNDRY TECHNOLOGY

(First Revision)

ICS 01.040.01; 77.020

BUREAU OF INDIAN STANDARDS
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General Metallurgical Standards Sectional Committee, MTD 1

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the General Metallurgical Standards Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard has been prepared for the guidance of manufacturers and consumers to assist them in the correct interpretation of common terms used in foundry practice. It is hoped that this glossary of terms will help in establishing a general recognized usage and eliminate ambiguity and confusion that might arise from individual interpretation of terms.

Metric system has been adopted in India and all quantities and dimensions in this standard have been given in this system.

This standard is intended mainly to cover technical definitions of terms relating to foundry technology, and it does not necessarily include all the legal meanings of the terms.

Indian Standard

GLOSSARY OF TERMS RELATING TO FOUNDRY TECHNOLOGY

(First Revision)

1 SCOPE

This standard is intended to define and explain the terms commonly used in foundry technology.

2 DEFINITIONS

A

Abrasion — Severe wear under the action of a hard solid or of hard particles.

Abrasive Belt — Flexible belt with one surface covered by abrasive material.

Abrasive Cut-off Machine — A machine using a thin abrasive wheel rotating at high speed to cut-off gates and risers from castings.

Abrasive Cut-off Wheel — The plastic discs impregnated with an abrasive for cutting ceramics and metals. Used on abrasive cut machines.

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

Accelerator — A substance that speeds a chemical reaction or activates a catalyst. Commonly used with such binders as synthetic resins, cement and so forth.

Acceptance Inspection — Inspection carried out by the purchaser's staff with the eventual help of the producer's personal, in order to decide if a material is accepted or rejected.

Acceptance Standards — Statement of conditions that defined goods have to comply with.

Acicular — Exhibiting a needle-like structure. Said of a structure whose main elements have a needle-like appearance when examined in a micrographic or macrographic section.

Acid Lining — Lining of a melting furnace made-up of an acid refractory.

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

Acid Refractory — Refractory material chiefly composed of oxides or acidically-reactive substances, that is, likely to combine at high temperatures with other oxides or basically-reactive substances to yield chemically-neutral compounds.

Acidic — Denotes a material (slag or refractory) whose index of basicity is less than 1.

Acidity of a Sand — Concentration in H^+ ions in a sand suspension the *p*H value of which is less than 7.

Acoustic Emission — An emission of acoustic or supersonic waves occurs in a material whenever a deformation is produced. Such emission is particularly important when there is a discontinuity, for instance a flaw or a crack in the material. Hence the recording and count of these emissions can help to detect flaws and cracks and to determine their severity and location. The advantage of this control method is the fact that it can be applied to parts under progressive stress.

Additive — Any material added to moulding sand or core sand for reasons other than cohesion.

Aerate the Sand — To give a sand by means of an appropriate treatment, the minimum apparent density.

Aerator — A machine used to break down, aerate, reduce bulk density and generally improves the moulding properties of sand.

AFS Standard Clay — That portion of foundry sand which, when suspended in water, fails to settle 25 mm per minute and which consists of particles less than 20 microns (0.02 mm) in diameter.

AFS Standard Sand — Washed, dried, rounded grain, silica sand, the grains of which all pass through a No. 40 sieve, 95 percent passing the No. 50 sieve, remaining on the No. 70 sieve. AFS fineness number 50 ± 1.

AFS Tests — A number of tests standardized by the American Foundrymen's Society to test moulding and core sands.

Air Dried Strength — Compression, shearing, tensile and bending strength of a sand hardened through exposure to dry air.

Air Dry — To leave to dry in the air (mould, core, lining).

Air Filter — Any method used to remove gases and particulates from the foundry environment and stack emission; it may be of cloth, fibre, liquid spray, electrostatic, sonic agglomerator, etc.

Air Furnace — Reverberatory type of furnace in which metal is melted by flame emanating from hearth and passing over the bath towards the application of stack at the other end of hearth; heat is also reflected from roof and side walls.

Air Hardening — The property of certain metals to harden upon air-cooling after heating above their critical temperature.

Air Port — Air inlet in an open hearth furnace.

Air Quenching — Cooling of alloys in air.

Air Refining — Elimination of one or several constituents of an alloy by oxidizing it with pure oxygen either blown on the surface on/or through the molten bath.

Air Scrubber — A purifying device for stopping all or part of gas mixing.

Air-Setting — It is the property to form permanent set at normal air temperature and is characteristic of some materials such as refractory cements, core pastes, binders and plastics.

Air Vent — Small sectioned groove leading from the moulding cavity to atmosphere and used for venting air from the cavity during filing.

Airset Binder — Binder commonly made up of drying or semi-drying oils containing oxygenated additives (perborates) that determine a slow air-setting rate without heat application.

Airslide — A device that conveys granular materials on air cushion system (Fig. 1).

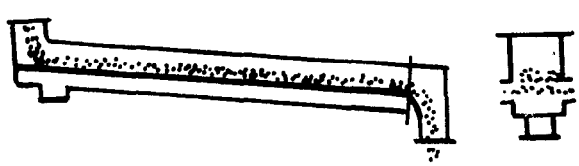


FIG. 1 AIRSLIDE

Alkaline Blackening — Producing a black oxide coating on steel by immersion in hot alkaline self solutions.

Alkaline Earths — Oxides of barium, calcium, strontium and radium.

Alligator — A machine for shearing metal scrap with strong jaws (as a crocodile squeezer or rock-breaker), one of which opens like the movable jaw of an alligator.

Alloy — Intimately-mixed substances one of which at least is a metal, such mixture having metallic properties.

Alloy Cast Irons — Cast irons to which additions of alloying elements have been made to confer specific properties.

Alloy Steel — A steel to which one or more alloying elements have been added for the purpose of modifying the properties.

Alloying Elements — Chemical elements introduced into an alloy.

Alpha Iron — An allotropic form of iron, stable below 910°C, characterized by a body-centered cubic crystal structure.

Alumsel — Proprietary name for a nickel-base alloy containing about 2.5 percent Mn, 2 percent Al and 1 percent Si, used chiefly in pyrometric thermocouples.

Alumina — Aluminium oxide (Al_2O_3), occurring native as corundum. It is prepared artificially as a white, amorphous powder or as a very hard crystalline substance resembling the natural corundum. The hard variety is used as an abrasive or refractory material.

Alumina-Silicate Brick — Brick made of a combination of alumina and silica.

Aluminium Bronze — Alloys of copper and aluminium 8.5 to 10.5 percent aluminium and eventually some additions of such as iron.

Aluminium-Copper Alloys — Aluminium alloys the chief alloying element of which is copper, in amounts ranging from 2 to 12 percent.

Aluminium-Magnesium Alloys — Aluminium alloys the chief alloying element of which is magnesium, in amounts ranging from 3 to 10 percent.

Aluminium-Silicon Alloys — Aluminium alloys the main alloying element of which is silicon. These alloys, the silicon content of which ranges from 2 to 10 percent, known as hypoeutectic, are the more commonly used. At about 12 percent silicon, the alloy is eutectic, a common trade name being 'ALPAX'. Alloys exceeding this content are referred to as hypereutectic and at levels of 16 to 22 percent silicon are sometimes called hypersilicon.

Aluminium-Zinc Alloys — Aluminium alloys the chief alloying element of which is zinc, in amounts approximating to 5 percent.

Aluminous Cement — Silicate cement first made in France by fusing slags high in alumina in an electric furnace.

Ammonium Bifluoride — Used in moulds and cores in magnesium casting as an oxidation inhibitor.

Ammonium Chloride — Ammonium chloride NH_4Cl, a useful flux for lead (Pb) and tin (Sn) base alloys.

Ammonium Sulphate — Used in compound to fireproof clothing of foundry workers.

Anchor Pin — Metal pin maintaining in position an assembly of separately fabricated cores or parts of moulds.

Anchor Plate — Bottom plate of small size, used in pit moulding.

Andalusite — A mineral with the essential composition Al_2O_3 and SiO_2 which alters to mullite at about 1 350°C.

Anisotropy — Feature of a material exhibiting properties with different values when measured along axes in different directions.

Anneal — Thermal treatment for the purpose of altering the structure of a metal or alloy by cancelling out the effect of previous thermal or mechanical treatments, to soften the material for easier machining or cold working, to lessen or do away with internal stresses, and so forth.

Annealing Pot — Container in which castings are packed during annealing operation.

Anode — In electrolysis, the electrode at which negative ions are discharged, positive ions are formed or other oxidizing reactions occur. It is the positive terminal of an electrolytic cell.

Anodizing — An electrolytic oxidation process in which the surface layer of aluminium or aluminium alloy is converted to a coating having protective, decorative or functional properties.

Anticarburising Compound — Compound applied to metallic surfaces to prevent surface carburization (mainly steels).

Antifriction Bearing — The active part of a bearing consisting of two raceways between which are balls or taper rollers of small diameter.

Antifriction Metal — Generic term applied mainly to lead-base bearing metals but also to tin and zinc-base alloys with low coefficients of sliding friction.

Anti-Piping Compound — Substance or compound placed on the molten-metal to isolate it from the environment either to prevent:

a) objectionable reactions; and

b) the molten-metal from cooling down.

Apron Conveyor — A continuous pan conveyor, carried by two strands of chain, used for carrying castings or feeding sand at a controlled rate.

Arc Cutting — Using an electric arc to cut metal.

Arc Welding — Welding accomplished by using an electric arc that can be formed between a metal or carbon electrode and the metal being welded; between two separate electrodes as in atomic hydrogen welding or between the two separate pieces being welded, as in flash welding.

Arch — The roof of a kiln or furnace,usually in arc shape, which tests its skew back on external steelwork or side walls.

Arch Brick — Brick used for circular walls. Two opposite edges are flat and set towards the centre of the construction while the other two are rounded off to the inner and outer radii (Fig. 2).

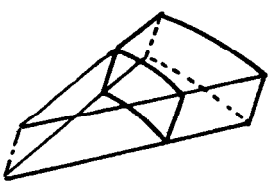


FIG. 2 ARCH BRICK

Artificial Ageing — A change of properties that may occur gradually at moderate temperatures somewhat more rapidly that at atmospheric temperature. Ageing following plastic straining is known as 'strain ageing'.

Artificial Sand — Sand derived from crushing a rock to the size of sand grains.

Asbestos (1) — A variety of amphibole occurring in delicate fibres or in a fibrous mass, usually referred to as a hydrated magnesium silicate, used for the purpose of insulating, fire-proofing or retention of various temperatures within an area. It possesses low heat conductivity and is commonly used to insulate risers, cores and certain mould area. Sometimes used as an ingredient in foundry sand to overcome certain mould or core volume changes.

Asbestos (2) — Refractory fibre of hydroxided natural silicate of calcium and magnesium. It is often used in the form of woven for making fire-proof clothes and protectors.

Asbestosis — An occupational disease affecting the respiratory system (bronchi, lungs, plevra), caused by inhalation of particles of asbestos.

As Cast Part — Referring to part which has not received any kind of finishing treatment after casting (beyond gate removal or sand blasting).

Assemble and Close the Mould — To assemble rigidly for casting all the parts of the mould which

have been separately prepared, such as: drag, cope, intermediate, cores, pouring basins, etc.

Assembly Mark — Hollow marking cut on a core print or the surface of a mould joint, and with a relief moulded counterpart to avoid errors and ensure precision in assembly in the absence of pins.

ASTM Comparative Method of Designating Grain Size — A method devised by the American Society for Testing and Materials in which the image of the structure of a suitable treated specimen is compared with a series of standard grain size charts indexed from 1 to 8.

Atmosphere — Gases in contact with the metal bath during melting and holding.

Atmospheric Feeder — Blind feeder head in which the atmospheric pressure is maintained by means of a sand protrusion or of a projecting permeable pencil (*a* and *b*) (Fig. 3).

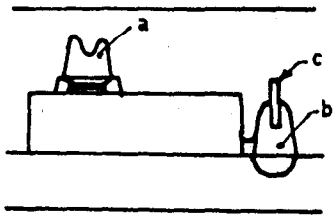


FIG. 3 ATMOSPHERIC FEEDER

Attached Foundry — A foundry that is an element of a manufacturing establishment or group and where castings are usually made for this establishment or for the parent companies.

Austenitic Cast Iron — The Indian Standard [IS 2749 Austenitic iron castings (*first revision*)] specifies requirements for 9 grades of flake graphite austenitic cast iron and 11 grades of spheroidal or nodular austenitic cast iron. The metallic matrix has been rendered austenitic at ambient temperature by the use of alloying elements.

Austenitic Manganese Cast Steel — Cast steel containing 1 to 1.35 percent carbon and at least 11 percent manganese.

Austenitizing — To produce austenite of a ferrous alloy by heating above the transformation temperature.

Autoclave — An airtight chamber wherein a specific pressure or vacuum can be kept up at a given temperature to bring about various physical or chemical changes. Used in lost-pattern foundries to do away with either patterns under steam pressure or residual moisture in vacuum.

Automatic Charging — Any automated process of charging raw materials in a melting furnace.

Automatic Control System — A control apparatus that keeps a function constant.

Automatic Ladling — This expression concerns exclusively the automatic mechanisms used for keeping cold chamber machines supplied with liquid metal.

Automatic Moulding — Performing all the sequences of moulding without manpower.

Automatic Sand Plant — Self-acting equipment for processing, reclaiming, transport and testing moulding sands qualitatively and quantitatively.

Automation — Automatically-controlled operation of a machine or a bank thereof system by mechanical or electronic devices that take the place of human organs of observation, effort and decision while retaining the traditional processing methods, even though the functional manufacturing layout may be quite different.

Average Particle Diameter — Diameter of a hypothetical particle which in some way represents the average of a group of particles.

B

Babbit's Metal — An antifriction bearing metal, usually 85 to 90 percent Sn, 3 to 15 percent Sb, and 2 to 6 percent Cu. Sometimes with up to 1 percent Cd.

Back Draft — Slope of a wall relative to the mould-stripping or mould-assembly direction such that it prevents stripping.

Back Plate — Insert placed between the movable platen of the machine and the corresponding die of the mould, comprising the essential part of the ejector mechanism and occasionally supporting certain cores (*see* 4 of Fig. 4). This insert can also serve to impart to the mould the minimum thickness required for the correct operation or adaptation of a given machine. In this case it is called the 'false back plate'.

Back Pressure — Opposition to flow of a liquid or gas, due to friction inertia, gravity or other cause.

Backing Sand — Reconditioned sand used for ramming main part of mould after pattern has been covered with facing sand. It usually consists of a porous mixture of burnt facing sand, moulding sand, cinder and clay.

Backup Coat — In investment casting, the ceramic slurry dip coat, applied in multiple layers, following the first dip to provide a shell-mould of a desired strength.

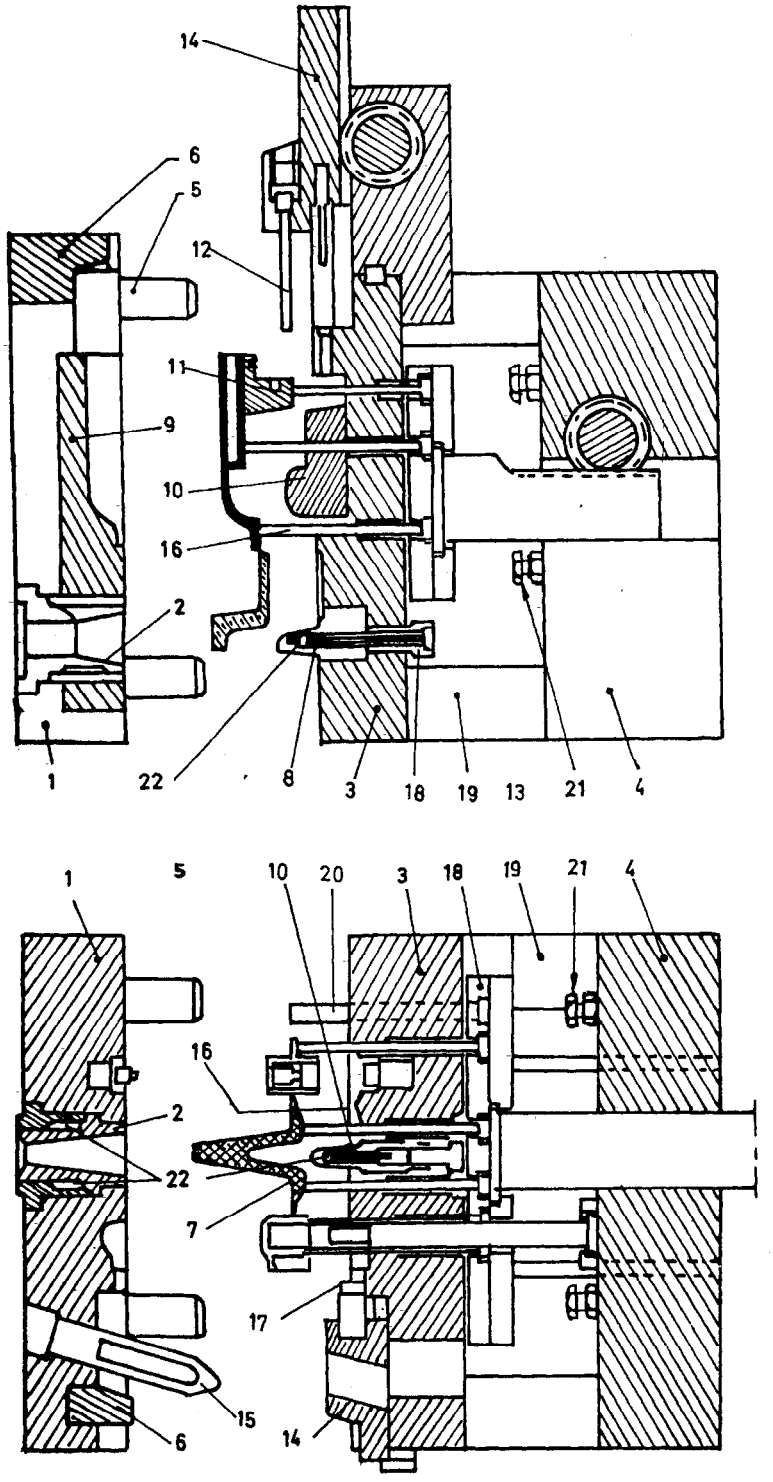


FIG. 4 BACK PLATE

Baffle (1) — Something for deflecting, checking or otherwise regulating flow (*a*) (Fig. 5).

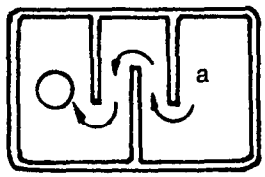


FIG. 5 BAFFLE

Baffle (2) — Device used for reducing noise.

NOTE — Sometimes a wavy roof may act as baffle.

Baffle Plate — A wall or plate in a fire box or furnace to deflect or change the direction of hot gases or flame.

Bail — Hoop or arched connection between crane hook and ladle, or between crane hook and mould trunions.

Bainite Spheroidal Graphite Cast Iron — Spheroidal graphite cast iron with matrix constituted of bainite.

Bainitic Cast Iron — Cast iron the matrix of which consists of bainite.

Bake/Baking — Controlled heating of cores so that core oil or other binder changes chemically and molecularly from liquid to solid by oxygen absorption.

Baked Core — A core which has been heated for sufficient time within a suitable range of temperature to produce desired physical properties attainable from its oxidizing and thermal setting binders.

Baked Strength — The maximum compressive, shear, tensile or transverse strength of a sand mixture which has been baked and cooled to room temperature.

Balanced Blast — Arrangement of tuyeres in cupola which provides for distributing or balancing the blast as required between upper and lower levels of melting zone.

Balanced Blast Tuyeres — Arrangement of tuyeres in a cupola distributing or balancing the blast as required between upper and lower levels of the melting zone.

Bale-Out Furnace — Furnace which can neither be shifted or tilted.

Ball Hardness Testing — Measurement of the hardness of a body, deduced from the diameter of the imprint left on that body by a ball to which a known load is applied.

Ball Mill — A mill in which material is finely ground by rotation in a drum along with pebbles or iron or steel balls. The grinding action is provided by the collision of the balls with one another and with the shell of the mill (Fig. 6).

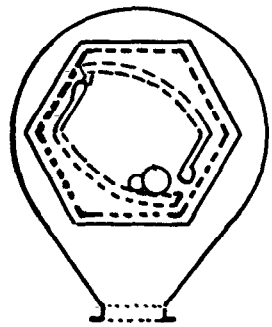


FIG. 6 BALL MILL

Ball Sizing — Sizing and finishing a hole by forcing through it a ball of suitable size, finish and hardness.

Banking the Cupola Furnace — Halting the flow of molten-metal by cutting off the cupola blowers after introduction of some coke which keeps up a moderate temperature by burning on natural draught induced through the tuyeres which are kept open for safety reasons.

Bar Plate — Plate supporting and guiding the parts of the core box for squeezing.

Barred Box — Box fitted with internal bars which, while strengthening the box, assist in maintaining the sand in position and a fitting the lifters (Fig. 7).

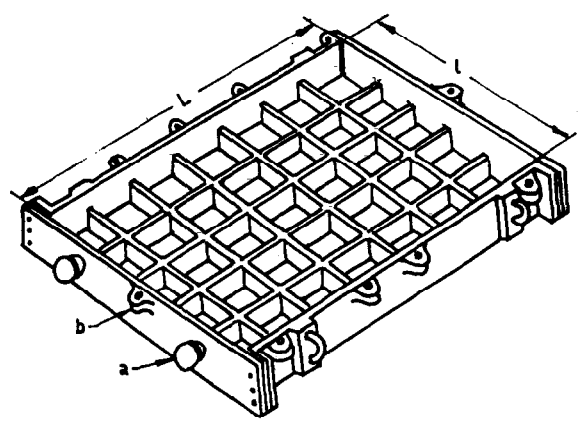


FIG. 7 BARRED BOX

Base Iron — Cast iron which is present in the largest proportion in an alloy and to which additions are brought. In a wider sense, cast iron to which any additional treatment is applied, after processing and before pouring.

Base Metal — Predominant metal in an alloy.

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

Basic — Denotes a material slag or refractory whose index of basicity is greater than 1.

Basic Lining — Lining of a melting furnace made-up of a basic refractory.

Basic Process — Steel making process, employing a basic-lined converter whereby sulphur and phosphorous is removed.

Basic Refractory — Refractory material chiefly composed of oxides or basically-reactive substances, that is, likely to combine at high temperatures with other oxides or acidically reactive substances to yield chemically neutral components.

Basic Steel — Steel made using a basic slag.

Basicity of a Sand — Concentration of H^+ ions in a sand suspension the *p*H value of which is higher than 7.

Batch (1) — Amount of material, generally expressed in weight, that tallies with the processing capacity, at one time, of a batch-operated unit.

Batch (2) — A batch is defined as being the castings poured from the same ladle and, where applicable, which have been submitted to the same heat treatment.

Batch Melting — Operation whereby the metal output of a furnace is available from a single charge after emptying the furnace.

Batch Mill — Batch-operated sand-processing equipment performing concomitantly the grinding and milling operations.

Batch Sand Mixer — Machine for mixing non-clayey sands, comprising kneader arms which thoroughly mix the various previously.

Batch Sand Plant — Plant for processing moulding sand, in one or several units in batch operation.

Batch Stove — A stove (oven) where in a charge is fully dried prior to introduction of the next charge.

Bath — Molten-metal in a furnace, a crucible or a ladle.

Batten — Reinforcement applied to the pattern to strengthen it and obviate its deformation when the mould in rammed. Its impression is then filled up with sand.

Bearing Metal — Generic term applied mainly to lead-base bearing metals but also to tin and zinc-base alloys with low coefficients of sliding friction.

Bed Joint — Horizontal joint between courses of brick.

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

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

Bell — Bell shaped metal or refractory material instrument for immersing additives deep into a molten pool (Fig. 8).

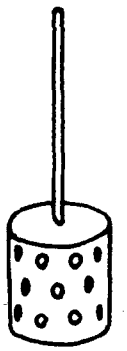


FIG. 8 BELL

Belt — A band of leather or other flexible material connecting a set of pulleys.

Belt Conveyor — A conveyor using a moving belt for the conveying medium. The belt is usually driven by a drum at one end, passing over a free-running drum at the other end. This type of conveyor can be arranged for horizontal or inclined travel (Fig. 9).

FIG. 9 BELT CONVEYOR

Belt Feeder — A short-belt conveyor under a hopper that discharges and meters its contents.

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

Bench Moulder — A craftsman who makes moulds for smaller type castings, working at the moulder's bench only.

Bench Rammer — A short rammer used by bench moulders (Fig. 10).

FIG. 10 BENCH RAMMER

Bending Strength (Sand) — The bending strength of a hardened sand is the limiting stress that fractures in the middle of a parallelopiped test specimen whose ends rest on two supports.

Bentonite — Originally, a trade-name for the clays discovered at Fort-Benton (Wyoming-USA). Term currently applied to clays the principal constituent of which is a mineral of the montmorillonite family.

Beta Iron — An archaic term. A form of alpha iron at a temperature where it has lost most of its magnetic properties (786°C). There is no difference in the crystal structure of magnetic alpha iron and paramagnetic alpha iron, formely called beta iron.

Bimetal — Two dissimilar metals having different coefficients of thermal expansion, fused together into, for example, a strip, and so arranged as to bend under the influence of changes in temperature.

Bin — An enclosed place used for storage of fuel, sand, or metals or any bulk material.

Bin Gate — A device for blanking a hopper outlet.

Binary Alloy — An alloy that contains two principal elements.

Binder (1) — A substance that coalesces sand grains thus imparting them the cohesion necessary.

Binder (2) — In moulding with snap-moulds, this is the strap securing both parts of a snap-mould at the joint, placed in position before casting to avoid splitting of the mould under the effect of the liquid metal (*a*) (Fig. 11).

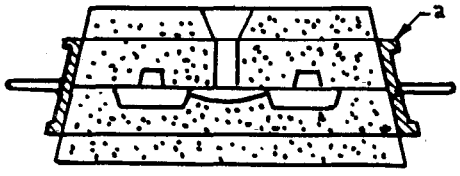


FIG. 11 BINDER (2)

Binder (3) — Metal strap embedded in the sand at the moment of ramming and serving for lateral support of the sand in a half snap-mould during casting (*a*) (Fig. 12).

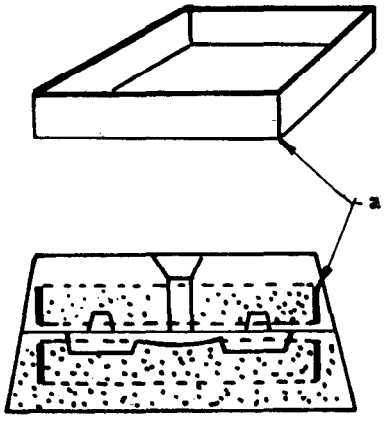


FIG. 12 BINDER (3)

Black Spots — The fracture surface shows clearly defined black spots of irregular shape, whose greatest dimension may range from a few millimetres to several centimetres. They are most prevalent for casting section thickness over 25 mm. The mechanical properties of the casting are very low.

Blacking Scab — An extra thickness of the metal, flat in size, having a rough texture and generally sharp sides and edges. If attached to the casting only at a few points it can be removed by means of a chisel. If solidly attached to the casting it can only be eliminated by grinding, however with the risk of leaving some sand inclusions.

Blackening Factor — Number allowing the smokiness evaluation with the help of tint conventional scales.

Blackheart — A dark discoloration sometimes seen in the interior of refractory bricks.

Blackheart Malleable Cast Iron — Cast iron that is cast white and made malleable by annealing in an inert medium, without decarburization, so that the carbide is decomposed to ferrite and temper carbon.

Blacking Carbon — Finely-ground compound containing, in variable proportions, dry-steam coal, anthracite, graphite, coke, charcoal powder, fireclay, and used for the preparation of coatings for moulds and core to be hardened by stoving or baking.

Blanking-Off Plug — Plug blanking-off an aperture and clearing the latter when the level of molten-metal reaches a set level; occasionally used as a stopper rod in pouring basins (*a*) (Fig. 13).

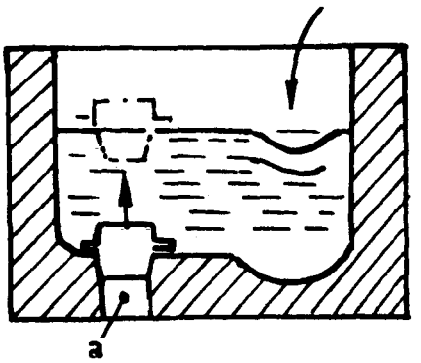


FIG. 13 BLANKING-OFF PLUG

Blast — High pressure signal and air rush produced by an explosion.

Blast Furnace — A shaft furnace supplied with an air blast (usually hot) and used for producing iron by smelting iron ore in a continuous operation. The raw materials (iron ore, coke and limestone) are charged at the top, and the molten iron and slag which collect at the bottom, are tapped out at intervals.

Blast Gate — Sliding plate in cupola blast pipe to regulate flow of air.

Blast Meter — Instrument for indicating volume, pressure and/or weight off air passing through blast pipe.

Blast Pipe — Pipes for conducting air under pressure, usually refers to section between blower or fan and cupola air belt.

Blast Pressure — Air pressure, or rather the excess air pressure in the wind box or tuyere when compared with atmospheric pressure, usually expressed in mm of the water pressure. The static pressure, which does not take motion into account and is measured with Rutter tube connected at right angles to the motion is to be distinguished from the total pressure which allows for the kinetic energy of the air in motion and is measured with a pressure gauge the in take of which faces the motion of the air (Pitot tube). The dynamic pressure head (*Hd*) is the difference between the two aforesaid pressures and gives the velocity *V* of the stream and hence the rate of flow of the air: $Q=S.V=S.4\sqrt{Hd}$. It is measured with a direct-reading Pitot-Rutter instrument.

Blind Bags — In air pollution control, air filter that have become saturated with pollutant.

Blind Riser — A feeder that does not break through the top of the cope and is entirely surrounded by sand (*a* and *b*) (Fig. 14).

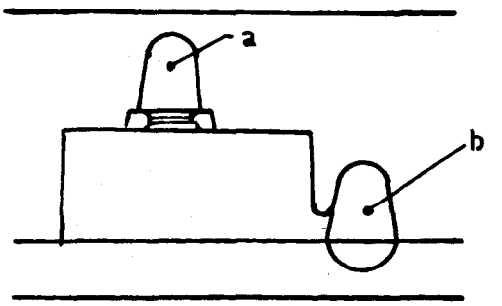


FIG. 14 BLIND RISER

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

Block-Mould — A mould consisting of an investment precoat encompassing the stacked pattern and another investment, adhering to the first and holding same in position, which fill in the space between the stacked patterns and the metal plate or mould member doing duty as a mould box.

Blow — Passage of air or gas evolved from either mould or core material, through molten-metal due to insufficient venting; also commonly used to indicate starting up of cupola and refining metal in converter or cupola.

Blower — Machine for supplying air under pressure to melting unit.

Blow Gun — Valve and nozzle attached to compressed air line and used to blow loose and or dirt from mould or pattern. It is also used for applying wet blacking and paint, and grit blasting.

Blow Hole (Gas Hole) — A casting defect caused by gas or steam trapped in metal before complete solidification takes place. These are characterized by irregular shaped cavities with smooth walls.

Blow Out (a Core or Part of a Mould) — To direct a current of air on to the surface of a mould or a core to clean it.

Blowpipe — A small pipe or tube through which air is blown for removing loose sand from small mould cavities.

Blow-Ramming Moulding Machine — Machine where the ramming of sand arises by means of the expansion of compressed air.

Blower Room — Room in which the blower is installed.

Blowing — Action consisting of projecting and ramming the moulding material, while transporting it with compressed air.

Blowing Plate — Perforated plate, between the core blower and the equipment to the filled, through which are perforated the blast holes.

Blowing Through — Operation consisting in bubbling a gas through a metal bath to stir it up.

Blueing — Formation of a very thin blue oxide film on polished steel or iron by heating in air by immersion in concentrated oxidizing solution.

Board — Tool for completing the ramming of the upper surface of a mould part (Fig. 15).

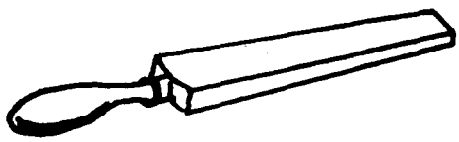


FIG. 15 BOARD

Bogie of Moving Hearth Furnace — Moving hearth of a heat-treatment furnace, which can be disconnected from same so as to make charging and discharging easier while another identical pre-charged hearth is moved into the furnace.

Boil (Carbon Boil) — Agitation of a bath caused by liberation of gas beneath surface. May be caused by wet furnace bottom or ladle, or may be deliberately induced by addition of oxidizing material to a bath containing excess carbon. In the latter case it is called carbon boil; carbon monoxide or carbon dioxide is evolved.

Bolster — Mould component which, when the mould includes inserts, permits them to be assembled in a rigid frame in such a way as to make up a single unit: the movable die or the fixed die.

Bond (Bonding Agent, Bonding Substance) — Any material, other than water, that imparts bond strength to foundry sands.

Bonding Clay — Any clay suitable for use as a bonding material (*see also* 'Bond').

Bond Strength — Property of foundry sand by virtue of which it offers resistance to deformation.

Boric Acid — A compound of boron, H_3Bo_3, commonly used as an inhibitor in facing sand in connection with casting of magnesium base and aluminium-magnesium alloys. The proportion varies between 0.5 percent to 2 percent dependent upon the alloy composition and whether other inhibitors are used at the same time.

Borings — Metal in chip form resulting from machining operations.

Bosh — In blast furnace or cupola the section where diameter increases to maximum above tuyeres.

Boss — A projection of circular cross-section on castings.

Bott — A mass of clay used to stop the flow of metal from the tap hole of cupola.

Botting — Inserting an earthen plug in the tap hole of the cupola furnace to stop the cast iron from running out.

Bott Stick — An iron rod, with a loop or long wooden handle at one end and a small round disc at the other, to receive the clay for botting off the cupola when the ladle is sufficiently full.

Bottom Brick (1) — Refractory brick, laid on the bottom of a mould or under the downgate base to strengthen the mould against the impact of the streaming metal.

Bottom Brick (2) — Refractory brick used in making bottoms of melting furnaces.

Bottom Doors — Hinged cast iron doors at cupola bottom upon which sand bottom is placed; bottom doors are opened at the end of the heat to allow coke bed and unmelted charges to fall (*see* Fig. 16)

Bottom Plate (1) — A metal plate upon which is placed the cylinder to make up a sealed container in which the holding investment is to be poured over the stacked patterns already coated with their contact investment.

Bottom Plate (in Foundry Pit) (2) — Plate in bottom of a foundry pit, occasionally used to anchor tie rods for pit moulding.

Bottom Pouring — Pouring procedure whereby the metal is poured via the bottom of the cavity.

Bottom Pouring Ladle — Ladle with a hole in the bottom and a stopper to block the hole. Upon removing the stopper, metal flows from the ladle (Fig. 17).

Boxless Mould/Snap Flask Mould — Sand mould separated from its moulding box prior to casting.

Branch Runner — Intermediate runner, in a multi-cavity mould, interconnecting the main runner and the gate of the cavity.

Brass Coating — Covering a base material by a film of copper-zinc alloy. It may be done electrolytically or by spraying.

Brazing — The process of joining two pieces of metal by fusing a layer of non-ferrous alloys that have melting points lower than those of the metals being joined.

Break — Local changes in brightness and formation of changeful and mobile patterns on the surface of a molten pool

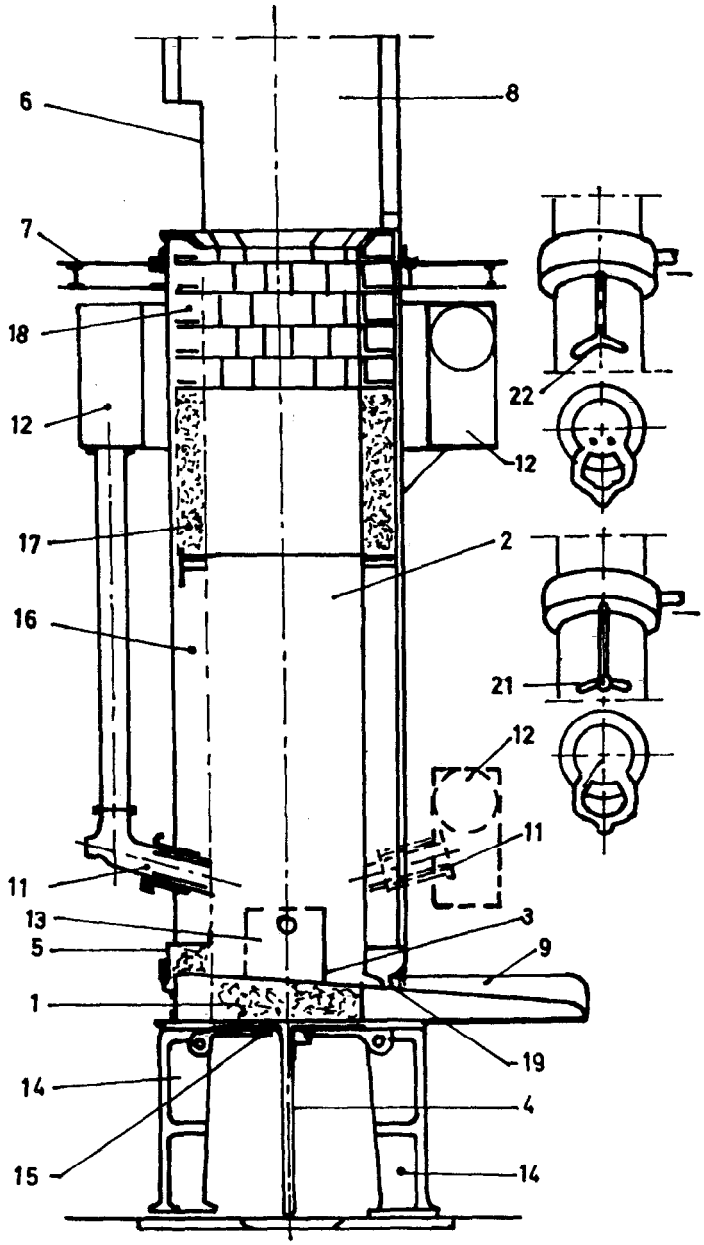


FIG. 16 CUPOLA

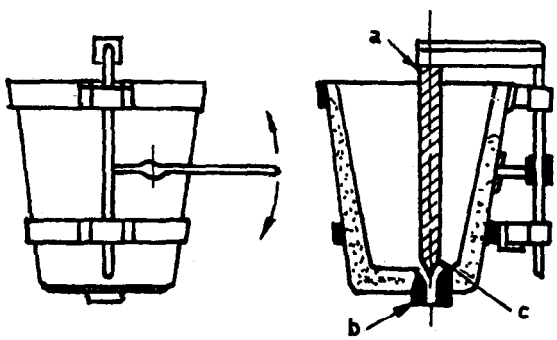


FIG. 17 BOTTOM POURING LADLE

Breaking Chamfer — Pattern or mould chamfer located at the junction of the gates and feeder heads with the casting, to prevent damage to the casting when separating the running and feeding system (*a*) (Fig. 18).

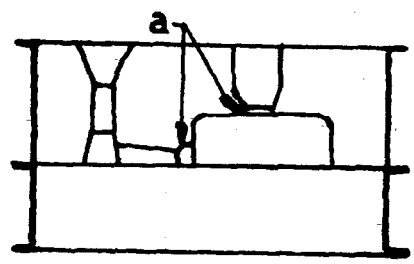


FIG. 18 BREAKING CHAMFER

Break-off Notch — A thinner section of a gate or riser to facilitate their removal and ensure clean breaking-off during the cleaning process.

Breast — Part of furnace lining connecting spout with bottom and made up with tap hole for every heat.

Breast Door — Opening provided at hearth level in the cupola furnace in order to permit passage of part of the hot gases, for preheating the hearth before fusion commences. It is closed up by a stopper device as soon as fusion begins (*see* 5 of Fig. 16).

Breathing Mask — A special mask worn over the face, used to facilitate breathing user with air or oxygen supplying.

Bridging — Solidification of slag within the cupola at or just above tuyeres or hanging up of a large charge piece.

Bright Annealing — A process carried out usually in a controlled furnace atmosphere so that surface does not oxidize and remains bright.

Bright Dipping — Brief immersion in a solution in order to produce a bright surface on a metal.

Bright Finish — A finish with a smooth surface of high specular reflection.

Briquette — Small cement-bonded ferro-alloy ingots brought into solid charges and containing specific amounts of elements such as silicon, manganese, chromium, etc.

Brittle Fracture — A break in metal without noticeable previous deformation.

Brittleness — A tendency to fracture without appreciable deformation.

Broken Mould — Buckling or breaking of a section of a mould due to incorrect register when closing as well as an indentation in the casting due to displacement of sand in the mould when the mould was closed.

Bronze — Copper-tin alloys with eventually one or several other constituents.

Brown Iron Ore — Hydrous ferric oxide $2Fe_2O_3.3H_2O$, an important ore of iron, occurring in stalactitic, mammillary, or earthy forms, of a dark brown colour, and as a yellowish-brown powder. Called also brown hematite.

Brush or Scraper Belt Cleaner — A device comprising brushes or scrapers that remove the foreign matter adhering to belts after a given running time.

Bucket — A vessel, such as a tub, or scoop, for hoisting or conveying materials. Types include elevator, clam shell, dragline, grab, loading, dumping, etc.

Bucket Elevator — An endless-chain elevator fitted with evenly-spaced buckets and in which, as a rule, in foundries, a belt is substituted for the chain (Fig. 19).

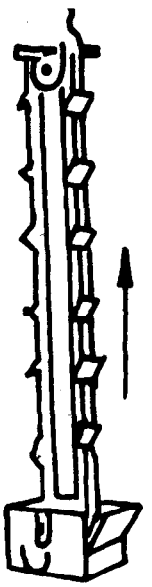


FIG. 19 BUCKET ELEVATOR

Bucket Loader — A mobile bucket conveyor for reclaiming bulk materials at ground level and loading them into lorries or open wagons (Fig. 20).

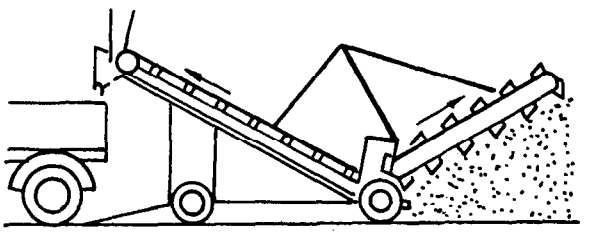


FIG. 20 BUCKET LOADER

Bucket Wheel — A hand-operated equipment shaped as a large shovel and fastened to rope of a winch (Fig. 21).

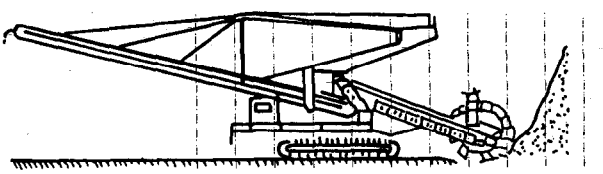


FIG. 21 BUCKET WHEEL

Buckle — Smooth-edged grooves on the surface of a casting. Usually in branching patterns, having a depth on the order of 2 mm.

Built-up Moulding Box — Box, generally of large dimensions, composed of removable elements assembled by means of bolts.

Buffer Coke Charge — Charge of coke added in the cupola furnace to the normal charge, either to restore the normal coke bed height or to separate two burdens of different compositions.

Bulging — Deformation of the pattern before moulding, of the mould before or during casting or of the casting during solidification and cooling or during heat treatment or machining.

Bulk Density (1) — Ratio of the mass of a material to its volume (including any inherent porosity).

Bulk Density (2) — The ratio of the mass of a material to its overall volume (including any inherent porosity).

Bull Ladle — A large ladle for carrying molten-metal.

Bull's Eyes Structure — Structure characterized by graphite nodules surrounded by ferrite in a perlitic matrix.

Bumper Bar — These components are rods either fastened to the rear platen or floating free in the movable plate, in which case they bear against a thrust plate as opening ends. They eject the castings by securing the ejector plate as the machine's stroke ends.

Bumper Ejection — An ejection system in which a relative motion occurs between the mould and ejection plate, the latter coming to a halt as opening of the machine ends owing to the action of rods known as bumper bars.

Bumper Plate (1) — Platen integral with the rod of the ram and usually guided by two guide pins. If the ram is of the double acting type, the bumper plate comprises as attachment for the ejector plate.

Bumper Plate (2) — Thrust plate for the ejector rods when not fastened to the rear platen.

Bung of Furnace — Furnace roof, made up of movable refractory arch-bricks held together by a metal support used for handling the said roof.

Burden — Listing of suitably-proportioned materials put into a melting unit to derive a specified metallurgical product.

Burden Specification — Listing of the amount of materials needed for the burden in order to obtain the required product.

Burn — Refers to oxidation of materials.

Burner — A device which mixes fuel with air intimately to provide good combustion.

Burn in — A thin layer of fused sand which has adhered tightly to the casting. The surface has a vitreous and possibly a pockmarked appearance.

Burn on — A strongly adherent crust of sand on the casting which cannot be removed by a normal cycle of blast cleaning, but requires grinding away.

Burning (1) — Damage done, due to the atmosphere, to a non-ferrous metal either when melting or when being poured.

Burning (2) — Deterioration of a metal in the solid state, during heat treatment, by exceeding the temperature when fusion commences, which has caused the separation of certain constituents, or by heating in an oxidizing surrounding, which has caused the internal oxidation of the metal.

Burnt/Calcined Dolomite — Refractory product (CaO + MgO) obtained by decomposition during firing of the natural dolomite $CaMg(CO_3)_2$ above 1 450°C.

Burnt Sand — Moulding sand or core sand which, on contact with the liquid metal, has attained such a high temperature that it has lost all or part of its initial qualities.

Burr — Sharp and ragged edges left after shearing or sawing.

Bursting — Refractories at high temperature swelling and growing until they break away.

Bush Runner/Pouring Basin — Separately made-up receptacle, comprising a bottom hole in alignment with the downgate. Positioned on the top of the mould, its purpose is to control the metal supplied by the pouring ladle in relation to the capacity of the gating system (Fig. 22) and (*b*) (Fig. 23).

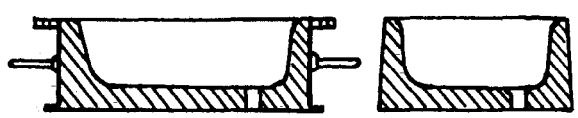


FIG. 22 BUSH RUNNER

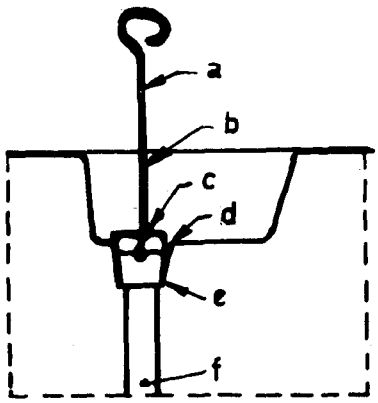
By-Product Coke (Gas Coke) — Coke produced from bituminous coal in airtight coke ovens where heat for coking process is externally applied.

C

Cadmium Coating — Cadmium coating may be obtained electrolytically or by spraying.

Camber (1) — A defect in long thin section of casting.

Camber (2) — An allowance to be kept on patterns.



a — Stopper rod
b — Pouring basin
c — Sprue stopper
d — Pouring nozzle
e — Mould
f — Sprue

FIG. 23 POURING BASIN

Calcium-Silicon — An alloy of calcium and silicon containing 30 to 35 percent Ca, 60 to 65 percent Si, used as a deoxidizer and degasser for steel and as an inoculating agent for cast iron. Not recommended term: calcium silicide.

Campaign — Period in which a furnace has been in continuous operation.

Captive Foundry — *See* 'Attached foundry'.

Carbide — A compound of carbon in chemical combination with one or more metallic elements.

Carbon and Low Alloy Cast Steel for Heat Treatment — Cast steels have generally to be supplied in the heat treated condition; those intended for case hardening are supplied in the cast, annealed, normalized or normalized and tempered condition.

Carbon Dioxide (CO_2) — A gas resulting from the complete combustion of carbon.

Carbon Dioxide Moulding/CO_2 Moulding — A moulding process involving a bonded sodium silicate sand which hardens within seconds by blowing carbon dioxide through it prior to stripping.

Carbon Equivalent Meter — A high-speed electronic temperature recorder connected to a thermocouple around which molten iron samples are poured. As the iron solidifies, liquidus and solidus are indicated in a curve drawn by the recorder. The indication is important because carbon equivalent (C + *1* Si) is directly related to liquidus temperature.

Carbon Equivalent (Value) — The carbon equivalent value of unalloyed, untreated grey cast iron.

Carbon Flotation — In spheroidal graphite cast iron castings it happens that graphite has accumulated by flotation in cope edges. The nodules are often exploded and there is also an enrichment in oxide and sulphide of magnesium. The material has poor mechanical properties.

Carbon Sand — A moulding aggregate consisting principally of carbon granules.

Carbonization — Driving off the volatile matter from fuels such as coal and wood by heating up to adequate temperature for a time long enough. The residue left by this operation is coke or charcoal (should not be confused with carburizing).

Carborundum — An abrasive essentially composed of silicon carbide.

Casing/Shell — Metal skeleton furnace used as support or casing for a refractory lining.

Cast — Performing a casting (or pouring) operation.

Cast-in-Insert/Insert — Part formed from another material, usually a metal, placed in the mould and appearing as integral structural part of the final casting.

Cast in Vertical Clamped Moulds — To cast one or more moulds clamped between the plates of a press.

Cast into Ingots — To cast metal into ingots.

Cast Iron (1) — Alloy of iron and carbon containing more than 1.7 percent of carbon and generally between 2.4 and 4.0 percent of carbon. Silicon, manganese, sulphur and phosphorus are also present in varying amounts. Alloy primarily of iron, carbon and silicon in which the carbon is in excess of the amount that can be retained in solid state or in austenite at the eutectic temperature (*see also* 'Cast iron, white').

Cast Iron (2) — Cast iron derived through remelting pig iron often mixed with scrap iron, such as selected scrap and whose chemical composition may or may not be altered by additions of ferro-alloys.

Cast Iron, White — Cast iron in which substantially all the carbon is present in the form of iron carbide. Such a material has white fracture.

Cast Iron Growth (1) — Permanent increase in the volume of a piece of cast iron, resulting from repeated or prolonged heating over 500°C approximately.

Cast Iron Growth (2) — Enlargement of an iron casting due to graphitization during solidification or cooling.

Cast Iron Scrap — Any unserviceable cast iron member or part thereof to be melted down.

Cast Plastic Material — Synthetic resin, cast in a cavity with a hardener that initiates the curing process

subsequently to the casting operation.

Cast Steel/Cast Steel for General Engineering Purposes — Steel in the form of castings.

Cast Plate — Metal plate, usually of aluminium, cast with cope pattern on one side and the drag pattern on the other (*see also* 'Match plate').

Cast Structure — The structure, on a macroscopic or microscopic scale, of a cast alloy that consists of cored dendrites and, in some alloys, a new work of other constituents unmodified by heat treatment.

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

Castability — Property of a metal or liquid alloy to fill a mould property.

Castable Refractory Concrete — Material made up from refractory grains bonded together by refractory cement. Consistency of castable concrete, prior to setting, is such that it is castable in rigid dies, thus providing suitably-shaped refractory components, and castable direct in shutterings.

Caster — Workman who carries out the casting operation.

Casting (1) — A metal object cast to required shape by pouring or otherwise injecting liquid metal into mould, as distinct from one shaped by mechanical process.

Casting (2) — Act of pouring molten-metal into mould is also known as casting.

Casting, Centrifugal — Process of filling mould by pouring metal into sand or permanent mould that is revolving about either its horizontal, vertical or inclined axis (*see also* 'Casting, centrifuge').

Casting, Centrifuge — A casting technique in which mould cavities are spaced symmetrically about a vertical axial common downgate. The whole assembly is rotated about that axis during pouring and solidification.

Casting, Gravity Die or Non-Pressure — The process of pouring molten-metal in permanent moulds without applying any pressure.

Casting, Investing — The process of casting metal into an investment mould (*see also* 'Lost wax process').

Casting, Machine — Process of casting by machine.

Casting Bay — Area in the shop reserved for the casting of moulds.

Casting Bed/Sand Bed — Thin bed of sand upon which the mould is placed for pouring.

Casting Drawing — Drawing derived from the finished-machine drawing showing machining allowances, the design altered to allow for feeding or stripping location of the jigging points, the datum planes, the casting tolerance limits, the grade of metal, and heat treatment if any. This is the reference drawing used by the inspection department when checking the rough casting.

Casting on Flat — Casting method in which the mould joint is horizontal.

Casting on an Inclined Bland — Casting into an inclined (or banked) mould.

Casting Pit — Permanent excavation made in a foundry floor to receive moulds of great height in order to facilitate casting.

Cauliflowering — Phenomenon produced during the solidification of a metal or of an alloy, by expulsion of dissolved gases. The phenomenon appears in the form of inflation of the surface crust of the solidified casting or riser, or by blisters or flaking. It can also result from the formation of a phase lighter than the average of the casting.

Caustic Dip — Immersion in a solution of sodium hydroxide to clean the surface or, when working with aluminium alloys, to reveal macrostructure.

Cavitation — The formation of partial vacuum in a liquid as a result of a movement of a solid in this liquid, and the pitting or wearing away of the surface of such solid as a result of these vacuums.

Cavity — The impression in mould produced by withdrawal of pattern and to be filled by casting metal. Alternatively it is a hollow or sunken space or void in the interior of casting.

Cavityless Casting/Full Mould Process — A technique using a polystyrene foam pattern in moulding sand, remaining in the mould during casting and volatilized by the heat of the molten-metal.

Cement, Metallic — Finely divided metal or alloy combined with a water soluble binder which hardens shortly after addition of water to form a hard compact mass.

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

Cement Moulding — Moulding process involving cement-bonded sand (8 to 10 percent) packed in the semi-liquid state and which cold hardens in some hours.

Cement Sand — A synthetic sand that is bonded with Portland cement.

Centerline Shrinkage/Axial Shrinkage — Shrinkage porosity occurring along the central plane or axis of a casting occurring generally in sections which are plate-like, cylinder or prism-like in shape.

Centreline/Axis — The line passing through the middle of any object.

Centrifugal Casting Die — Metal mould for centrifugal casting.

Centrifugal Collector/Cyclone — A controlled descending vertex created to spiral objectionable gases and dust to the bottom of a collector cone (Fig. 24). Designs: tangential cyclone, axial cyclone.

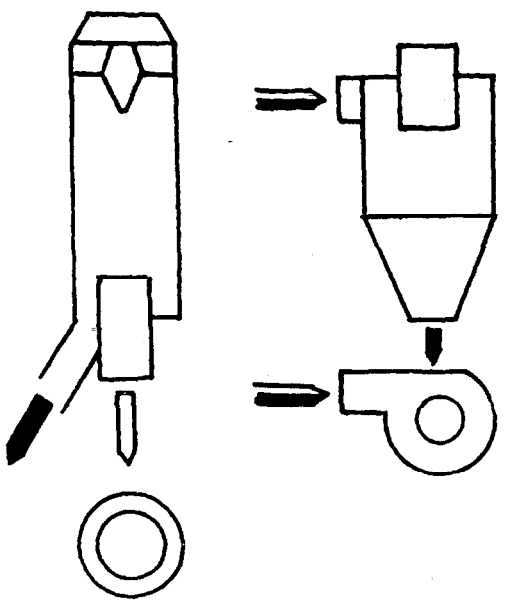


FIG. 24 CENTRIFUGAL COLLECTOR

Centrifugal Disintegrator/Centrifugal Cutter — Disintegrator in which the sand flows through one or several ducted turbines which channel the sand fed out therefrom as required (Fig. 25).

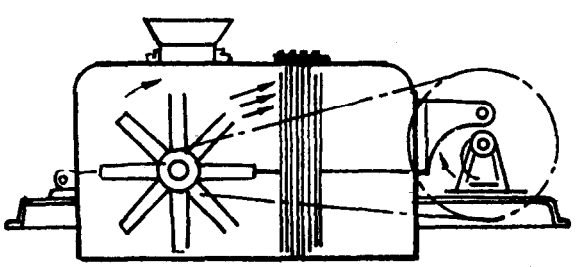


FIG. 25 CENTRIFUGAL DISINTEGRATOR

Centrifugal Pressure Casting — Centrifugal casting process where the mould is filled in the vicinity of or by the axis of rotation, but where the castings of whatever shape comprising either one or more cores, are evenly distributed about the said axis.

Centering Bridge — Plate used to materialize the center of a hollow cylinder structure.

Ceramic Moulding — Moulding process involving a fine-grained, ceramic refractory, packed by pouring it on the pattern of into the core box. The binders it contains partly give rise to a cold, initial hardening resulting in an elastic bond whereby the latter is stripped, having retained satisfactory shapes, the hardening process being completed in a drying oven.

Cereal Binder — A binder used in core mixtures and moulding sands derived principally from corn flour.

Cermet — A metal ceramic high in Cr and Al_2O_3.

Chain — A series of metal links interconnected so as to move freely.

Chain Hoist/Chain Block — A hoisting tackle employing an endless chain operated from an overhead track for hoisting heavy weights (Fig. 26).

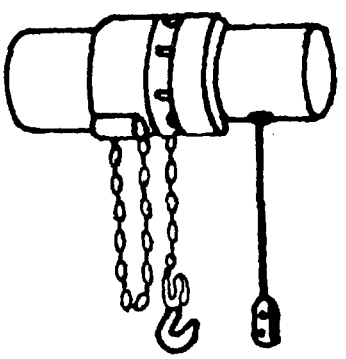


FIG. 26 CHAIN HOIST

Chamfer — To bevel a sharp edge or corner (Fig. 27).

FIG. 27 CHAMFER

Chamotte — A highly calcined flint clay which when mixed either with raw clay or with sand and raw clay is used as a moulding material for steel castings.

Chamotte Brick — Brick obtained by firing a mixture of chamotte and untreated clay.

Chamotte Sand — A sand the constituent of which is chamotte.

Channel Type Induction Furnace — Furnace in which the secondary circuit is made up by a ring of liquid metal.

Chaplet (or Anchor) — Metal support or spacer used in mould to hold cores, or parts of the mould which are not self-supporting in there proper positions during the casting process. There are numerous sizes and shapes, as radiator, double-headed, cast, stem; sheet metal and perforated (*see* Fig. 28).

Charcoal — Solid fuel made by the distillation of wood.

Charcoal Pig Iron/Swedish Iron — A high purity pig iron obtained through the reduction of high grade ores in a blast furnace (charcoal may be used to perform the reduction).

Charcoal Powder — Foundry blaking prepared from charcoal.

Charge — A given weight of metal or fuel introduced into cupola or furnace.

Charge of a Furnace — Suitably proportioned materials, making up both the burden and unit charges of an item of melting equipment.

Charge Sheet — Record of materials charged into a furnace.

Charged Metal — Amount of metal charged into the melting furnace.

Charger of Furnace — Furnace charging hand.

Charging Deck — Floor, next to the charging door or at the top of a furnace, from which charging is performed (*see* 7 of Fig. 16).

Charging Device — Mechanical equipment used to place the charge in the furnace.

Charging Door — Opening situated in the upper part of the body of the cupola furnace, through which the charges are introduced (*see* 6 of Fig. 16).

Charging Platform/Charging Floor — *See* 'Charging deck'.

Checkerbrick — Brick used in regenerator for checkerwork construction to absorb heat alternately from exhaust gases and give up heat to incoming gases.

Cheek — Intermediate section of a flask that is inserted between cope and drag to decrease difficulty of moulding unusual shape or to have more than one parting line where so required (Fig. 29).

Cheek, False — Cheek used in making a three part mould in two part flask.

Chill (1) — A material or component of high thermal conductivity used in mould or core to accelerate cooling and to control structure in casting used internally or externally.

Chill (2) (Term Solely Used for Casting Steels or Non-ferrous Metals) — Metal component of comparatively small size inserted in a sand mould, either on or inside the cavity, to increase the cooling rate of the metal when brought into contact with the latter.

Chill (3) — Surface chill for speeding up the cooling rate such that the layer of frozen cast iron be white upon making contact with the said layer. Term applicable to sand-moulded cast iron for making chilled iron castings.

Chill (4) — To line with surface denseners the portions of a sand mould's surface the cooling down of which is to be speeded up (this term is only applicable to non-ferrous metals).

Chill Block — Test piece cast in a die or against a chill the fracture of which shows the extent of the chilled part.

Chill Coil — Internal chill made of steel wire formed into helical coil or spiral.

Chill Depth — Depth of white iron caused by cooling during-solidification, faster on the surface than within a casting or faster in the thin part than in the thick part of a wedge-shaped test piece.

Chill Nail — Special steel nails with heavy heads which are placed in certain mould sections to hasten solidification of metal. Also used to support sand facing against which metal will lie.

Chilled Iron — Cast iron in which carbon is retained in combined form in certain areas sufficient to form mottled or white structure due to conditions which accelerate cooling to the extent that normal graphitization is prevented in those areas.

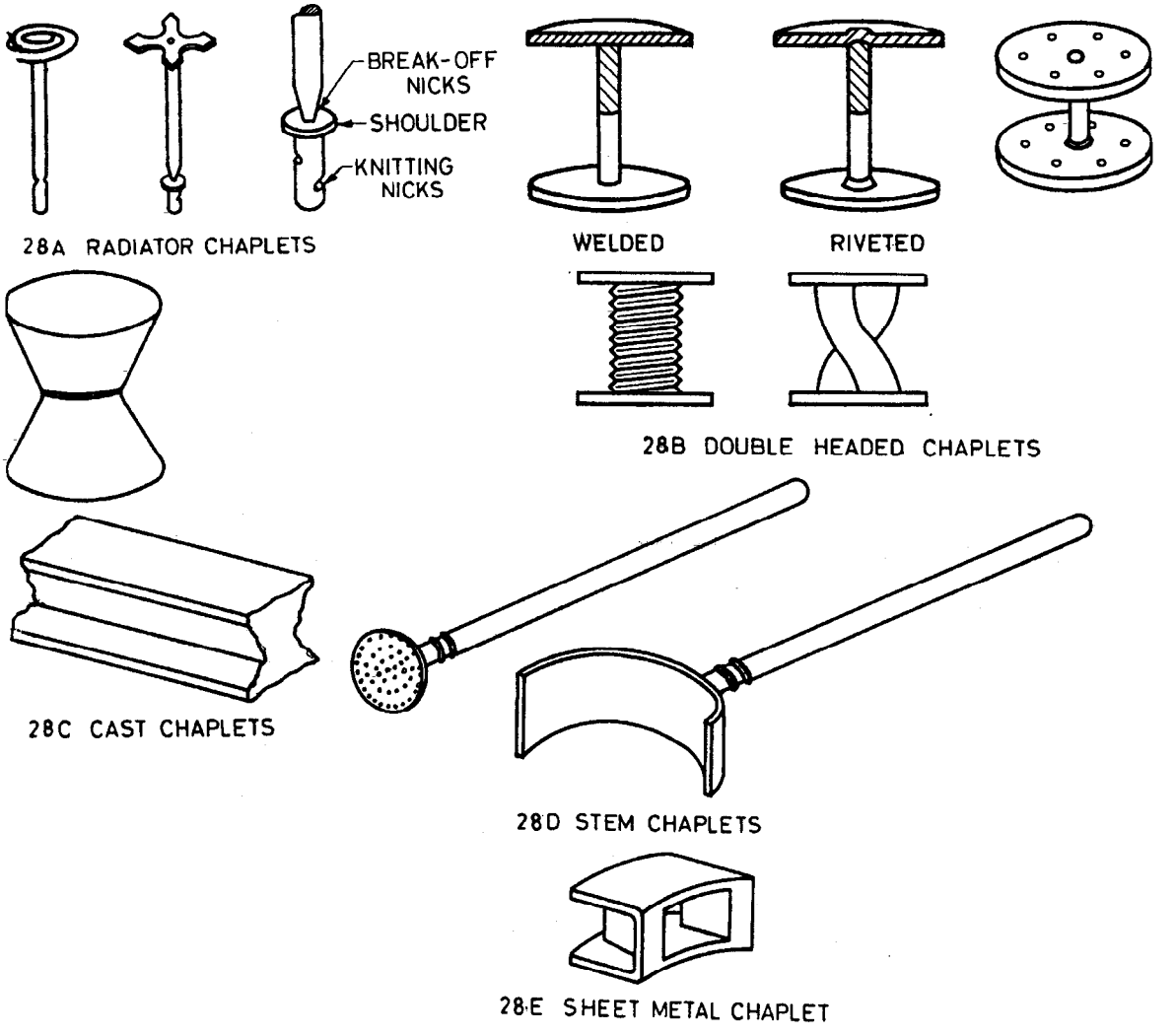
Chilled Shot — Cast iron shot produced by allowing molten-metal to fall dropwise through space into water-bath and graded in sizes for abrasives.

Chilled Spots or Edges — White iron structure, at least partially, especially in thin sections or at corners and edges which changes progressively or abruptly to a normal structure.

Chimney Hood — Protective covering over a chimney-head.

China Wood Oil — A fast drying oil (twice as fast as linseed oil) used in the manufacture of certain core oils for foundry use.

Chinese Scriot — A configuration typical of the constituents in cast aluminium alloys containing



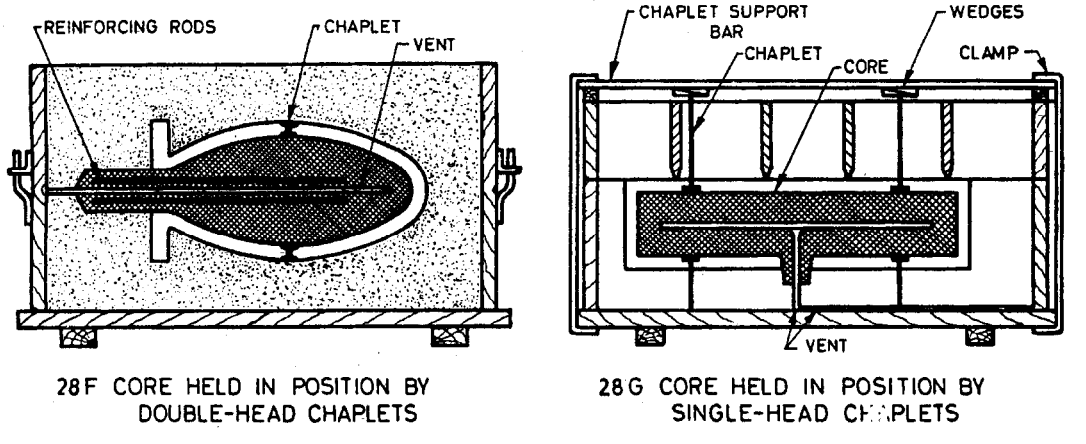


FIG. 28 CHAPLETS

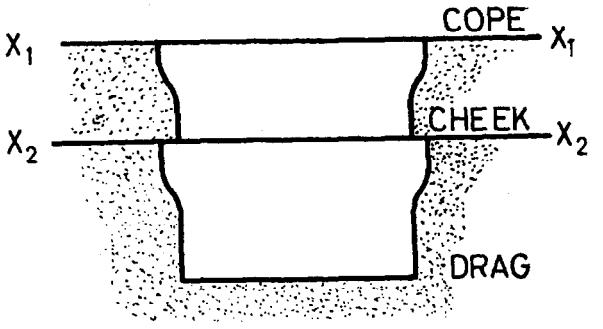


FIG. 29 CHEEK

specific amounts of iron and silicon; applies also to a similar structure found in magnesium alloys containing silicon.

Chipping — Removal of fins and other excess metal from castings by means of chisels and other suitable tools.

Chipping Hammer — A chipping tool operated by compressed air.

Chipping-Out/Fettling — Process of removing slag and refuse attached to lining of cupola or furnace after a heat has been run.

Chlorination — A metal refining process whereby chlorine gas is passed through molten magnesium or aluminium alloys to remove dissolved gases and entrapped oxides from the molten-metal.

Choke — Narrowed cross-section of a gating system designed to choke the pouring basin, thus curtailing the amount of slag likely to enter the mould cavity.

Choke the Sprue — This consists in pouring the molten-metal quickly into the pouring basin and keeping up the level therein throughout the pouring process.

Choked Area — Restricted input of gating system.

Choked Runner System — A restriction placed in the running system to help to maintain a full sprue; placed usually at the exit area of the sprue.

Chrome Brick — Refractory brick made substantially of refractory chrome ore.

Chrome-Magnesite — Compound obtained by mixing chromite and calcined magnesite.

Chromel-Alumel Thermocouple — Electric thermocouple a lead of which consists of a nickel/chromium alloy (90/10), the other of a nickel-aluminium alloy (98/2).

Chromisation — Thermochemical diffusion treatment of chromium into steel, resulting in an improvement of its superficial hardness and its resistance to wear and corrosion.

Chromite/Chrome-Iron Ore — The principal ore of chromium in which the metal exists as a complex oxide ($FeO.Cr_2O_3$). Also used as a refractory in furnace lining.

Chromite Sand — A sand the constituent of which is chamotte.

Chromium-Copper Alloy — Copper alloy containing 0.5 percent to 1 percent of chromium.

Chromium Plating — Any method to obtain a deposit of chromium on the surface of a material. Following sorts of chromium plating can be considered: crack chromium not exceeding 25 µm thickness and offering great resistance to corrosion; porous chromium produced to obtain an oil retaining surface; conventional hard chromium with thickness over 50 µm and as plated hardness between 800 and 1 100 HV.

Chunk Graphite — Graphite in the shape of irregular or incomplete spheres or in spheres divided by deep groves in which the matrix penetrates. It may appear in very pure irons or in nickel containing austenitic irons with high carbon and/or silicon content.

Chvorinov's Rule — The time (t) a quantity of metal remains molten is proportional to the square of the ratio of volume (v) to the area (a), of contact with the mould; it can be expressed by:

$$t = k$$

Cinder/Slag/Dross — Heterogeneous solid matter forming when molten-metal combines with the atmosphere or the refractories, and which usually remains at the top of the metal bath, or may accumulate in some parts of the equipment.

Clamp (1) — Metal fitting for fastening the die blocks to the platens of the pressure-die casting machines.

Clamp (2) — A device for holding parts of a mould flask, core box, etc, together.

Clamp-Off — Depression or cavity, often over a large area of the part having the same general finish as the rest of the casting surface. There is no corresponding surface projection else where.

Clamping Force/Locking Force — The force the die casting machine applies on the two halves of the die.

Clay — Structurally a bidimensionally laminated hydrated aluminosilicate, the largest particle size of which is less than 2 microns. There is virtually no pure naturally-occurring clay, the clay commonly found consisting of several minerals mixed with other components.

Clay-Graphite Mixture — A compound of graphite powder and clay used for making crucibles for melting metal or as a refractory to the melting furnaces or ladles.

Clay-Grog Mortar — A refractory mortar of ground clay and grog used in laying fireclay brick.

Clay (Plastic) — A clay with sufficient natural stickiness to bond together or to bond with others, materials which have little or no bond properties.

Clay Wash — Clay diluted with water to a creamy consistency and used as a mould.

Clean — To remove the sand that may still adhere to a shaken-out casting.

Cleaning Tool/Fettling Tool — Tool used to remove gates and fins after casting.

Clearance — Space allowed between the prints of the core and the mould to avoid any crushing when remoulding is being executed without visual observation.

Clearance Print — Prolongation of a coreprint without corresponding extension is the core box. The resultant void facilitates deposit of the core.The void can thereafter be filled in (*a*) (Fig. 30).

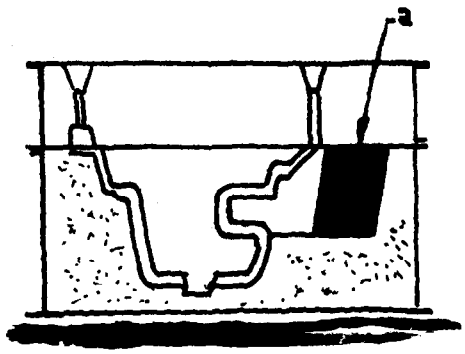


FIG. 30 CLEARANCE PRINT

Clearance Taper Coreprint — Coreprint extended in the direction opposite to stripping, the taper extending up to the joint face (*a*) (Fig. 31).

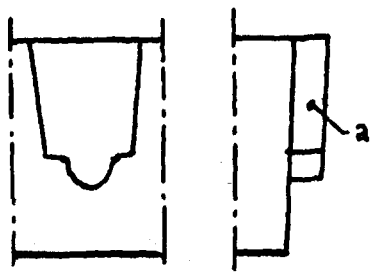


FIG. 31 CLEARANCE TAPER COREPRINT

Cleat — Wooden bar or strip fastened to moulding boards as to support and prevent distortion.

Cleavage Fracture — A break in metal without noticeable previous deformation

Clinker — Fused residual ash from coal or coke-fired furnaces.

Closing Cylinder/Die Close Cylinder — A hydraulic or pneumatic ram for closing the die casting machine either direct or by means of a toggle joint.

Closing Pin — Pin fixed on one of the boxes constituting a mould (*a*) (Fig. 32).

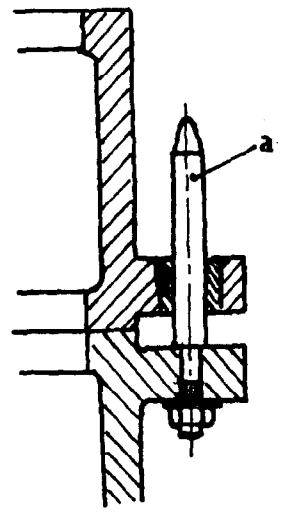


FIG. 32 CLOSING PIN

Closing Wedge/Sealing Wedge — Tapered wedge permitting cavities (or empty spaces) to be provided in the core, in which it will be possible either to pour white metal or install threaded rods in order to facilitate the assembly of several cores.

Coating/Dressing/Wash — Fine grained refractories suspended in a suitable liquid to which may be added a bonding and a wetting agent. The suspension is brushed over or sprayed on the surface of a mould or sand core.

Coating of a Sand — This consists in bonding the surface of sand grains with a resin while retaining for the sand:

a) its powdery condition permitting its use for blowing or gravity-feed shell moulding.

b) its properties on making contact with hot tool equipment.

Cobalt Plating — An electrolytic process consisting in depositing a layer of cobalt on ferrous or various non-ferrous alloys through immersion in a cobalt-sulphate solution. Cobalt plating is occasionally used instead of nickel prior to chromium plating.

Cod — The extension of sand of the cope downward into the drag (*a*) (Fig. 33).

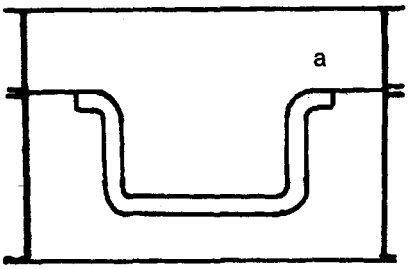


FIG. 33 COD

Cohesion of Sand — Force which maintains grains of sand in a united state.

Coining — A process for straightening and sizing castings by die pressing.

Coke — A porous, grey product resulting from the dry distillation of bituminous coal, petroleum or coal tar pitch, which drives off most of the volatile matter.

Coke Bed — Coke loaded in the cupola-furnace stack between the hearth and the tuyere area prior to introduction of the first batch. This part of the stack contains solely coke and molten-metal, all the solid or melting metal remaining above throughout the melting process.

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

Coke Split — Amount of coke put into the cupola furnace between the metal layers of two successive batches. This amount is equal to the weight of a batch of metal multiplied by the coke ratio which is determined in accordance with the metallurgical and thermal characteristics of the iron required.

Cold Box Moulding/Cold Box Core Making — A process involving a sand bonded by synthetic resins which a gaseous catalyst, blown into the filled and rammed core box, causes to cold set instantly.

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

Cold Lap/Cold Shut — A discontinuity with rounded edges extending either partially or entirely through the section of the casting. In mildest cases, it may consist merely of a shallow grove with rounded edges.

Cold Melt — Melting process consisting in rendering liquid a batch of solid metal in a single melting unit.

Cold Metal — Molten-metal whose temperature is too low to expect acceptable casting.

Cold Setting Binder/No Bake Binder/Air Bond — Binder that sets through a chemical reaction or loss of water without heat application.

Cold Shot — Metallic particle, generally spheroidal and located on the drag surface of the casting. The chemical composition is identical to that of the casting and the surface is generally oxidized.

Cold Tearing — A crack in the form of a visible fracture. The sharp edges delineate a fracture of constant width which in general extends entirely across the section. The texture of the surface has the appearance of a casting broken while cold. The walls are not oxidized.

Collapsibility — The ability of break down of a sand mixture, particularly a core sand after casting.

Collapsible Ram-Up Core — Collapsible core inserted in the mould in order to avoid casting distortion.

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

Colloidal Clay — Clay whose particles are so minute and of such nature that, when mixed with a suitable liquid, it remains in stable suspension.

Colloidal Material/Colloids — Minute particles, suspended in a liquid, giving rise to micellae and, usually, to a markedly increased viscosity. Typical examples: albumin, glue, starch, gelatin and bentonite.

Colour Comparator Pyrometer — An optical pyrometer utilizing several narrow band widths of the visible spectrum emitted by a heat source the colour temperature of which is to be measured.

Column/Tie Bar — Bar generally cylindrical in shape which joins together the front platen and the rear platen, acts as a guide and support for the movable platen, and the tensioning of which provides the mould-locking force.

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

Combination Hinged Core Box — Hinged core box a section of which consists of a detachable core carrier accommodating the core after stripping.

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

Combustible Lost-Pattern — A pattern that vanishes by combustion.

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

Combustion Chamber/Fire Box/Hearth —Space in a furnace where combustion takes place.

Compactibility — Capacity of a sand to be squeezed under pressure.

Complete Miscibility — Miscibility in any proportions.

Compressed Air Sandblaster — Sanding machine in which the abrasive material is shot by compressed air on the casting.

Compressive Strength/Yield Strength under Compression — Ability of a metal to withstand compression loads. As plastic metals do not show any well defined breakdown point under compression, it is usual to record compressive strength at a given amount of deformation (yield strength under compression).

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

Concentration — Numerical notation of the content.

Concentration of Sodium Silicate — Dry-extract content, or bulk concentration of SiO_2 + Na_2O, expressed in percent.

Conchoidal Fracture/Rock Candy Fracture — Fracture showing smooth, slightly curved facets, like that of rock candy.

Concrete — A mixture of sand and gravel of specific particle size, bound with cement.

Connor Block Runner/Lip Runner/Kiss Riser — Block in the cope or top-part of the mould with its bottom edge connected to the casting but slightly overlapping the mould cavity to form a narrow slit 1.6 mm wide, through which the metal poured into the block passes into the mould (Fig. 34).

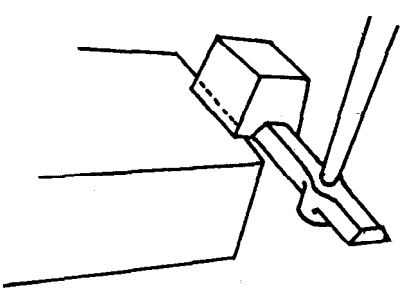


FIG. 34 CONNOR BLOCK RUNNER

Constantan — An alloy of nickel and copper used in thermocouples (45 percent nickel — 55 percent copper).

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

Consumable Material — Object, material or supply acquired by the company which takes only an indirect part in the manufacturing process and is not a component of the resulting product, for example fuels, sands and binders, refractory materials, etc.

Contamination/Pollution — Physical, chemical or biological pollutant propagation and transfer.

Continuous Annealing Furnace — A furnace in which castings are annealed by passing successively through different heat zones, each of these zones being kept at a different but constant temperature.

Continuous Casting — A process in which the metal is continuously solidified while being poured through a water cooled mould which determines a cross-sectional shape. Castings can be sawed off at any desired length.

Continuous Desulphuration — A continuous process for the removal or the diminution of sulphur in molten ferrous alloys.

Continuous Furnace — Continuously operating furnace.

Continuous Melting — Operation whereby the output of a furnace is continuously available from successive charges without thoroughly emptying the furnace.

Continuous Sand Mixer — Machine for mixing non-clayey sands. Comprising one or two mixing screws as well as a pumping system for distributing and proportioning the bonding agents.

Continuous Sand Plant — Plant for processing moulding sand in one or several continuously operated units.

Continuous Stove/Continuous Oven — Stove (oven) in which the products to be dried or fired are moved continuously through the stove (oven).

Continuous Tapping — Pouring from either a piece of melting equipment or a holding furnace whose molten-metal outlet is always open, for example a cupola furnace or syphon-brick.

Contraction Rule/Patternmaker's Rule — Graduated rule used for tracing and measuring patterns. Its divisions take account of the contraction of the casting.

Control — Permanent and automatic adjustment of a measurable quantity, for example temperature, flow rate, etc.

Control Panel/Switch Box — Unit in which are clustered the controls of the machine.

Controlled Atmosphere — Gaseous mixture the composition and pressure of which are controlled in a chamber to secure a given result.

Controlled Freezing — Controlled solidification such that additional molten-metal is always available to feed the solidifying portion of the casting.

Cooler — Equipment that evaporates by heating the water held in pit-run sand and then cools same.

Cooling Curve — A curve showing the relationship between time and temperature during the cooling of a sample.

Cooling Fin — Comparatively thin web arrangement at right angles on some portions of the rough casting and acting as cooling fins during solidification; often used to prevent hot tears in the concave corners of castings, and which may either remain or be removed when machine-finishing.

Cooling Stresses — Stresses developed in a part by uneven contraction or external constraint during solidification or cooling.

Cooling Tower — A structure over which water is cooled by free-circulating or pulsated air.

Cope/Top Part — Element of the mould in the upper position during casting.

Cope Box — Box specially designed to make up the to part of mould.

Cope Defect/Elephant Skin/Laps — Irregular, rough grained or folded surface having a shrivelled appearance, often with a somewhat deeper network of grooves or wrinkles.

Cope Raise/Raised Mould/Strained Castings — A phase used to describe the result when molten-metal is poured into the mould at too fast a rate of under too great metallostatic pressure, causing the cope to rise slightly from the drag and resulting in a oversize casting with protruding fins.

Cope Spall/Erosion Scab — Massive, rough, irregular layers of excess metal, generally several millimetres in thickness with edges of irregular shape having the appearance of fractures. There may be evidence of several crusts including sand crusts. Such scabs can only be removed by machining or grinding.

Copper-Lead — A mixture of copper and lead, very intimately mixed containing also other elements, as tin and nickel for instance: Cu_{68} Pb_{30} Sn_2. It is used for lining and also to cast bushes or other parts.

Core (1) — A preformed sand aggregate inserted in a mould to shape the interior or that part of a casting which cannot be shaped by pattern (*see* Fig. 35).

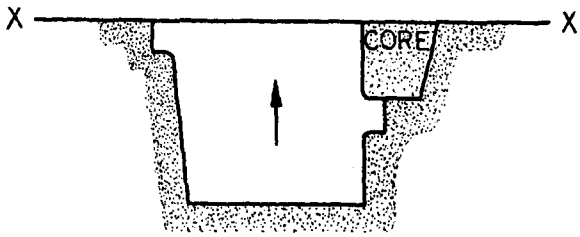


FIG. 35 CORE

Core (2) — Fixed or movable part of the mould (or die), permitting cavities or bores to be obtained in the casting.

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

Core Bedding Frame — Sharply tapered frame, generally made of wood, arranged at the joint of the core box in order to permit a thin layer of moulding sand to be applied before the core plate is positioned, when the core shapes are not smooth. After stripping and before stoving or drying, this frame is removed (*a*) (Fig. 36).

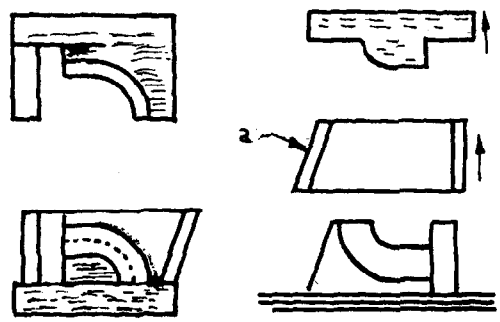


FIG. 36 CORE BEDDING FRAME

Core Binder — Bonding agent of a moulding or core sand, imparting coherence to it subsequently to bake-out, stoving or chemical setting.

Core Blower — A machine for making cores by blowing sand into the core box by means of compressed air. The air escapes from the core box through finely slotted openings.

Core Box — Wood, metal or plastic structure, the cavity of which has been made to the desire shape of the core which is to be made therein.

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

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

Core, Cake — A core in the shape of a flat slab.

Core Box for Blowing — Core box specially equipped to be used on a core-blowing machine.

Core Box Vent/Screen-Vent — Narrow-slotted component or plate with minute perforations, inserted in equipment to be filled by a blower, whereby the air may escape while holding back the moulding material.

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

Core Collapsibility — The rate of disintegration of core at elevated temperatures.

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

Core Cream — An emulsion of drying oil and water, often containing molasses, resin and dextrin.

Core Driers — Supports used to hold cores in shape while being baked; constructed from metal, sand or plastic material.

Core, Drop — A type of core used in forming comparatively small openings occurring above or below parting, the seat portion being so shaped that the core is easily dropped into place.

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

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

Core Gate — Core used for forming gate in mould.

Core, Green Sand — A core formed from the sand mixture in unbaked condition.

Core Grid — Reinforcing material for cores.

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

Core Gum — Gum used to stick up two pieces of cores.

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

Core Irons — An iron or steel bar, wire, or other shape used within core for strengthening it in green sand state to prevent distortion.

Core Jig — A device for setting core assemblies outside of mould and placing the hole assembly in the mould.

Core Knock-Out Machine — A mechanical device for removing cores from castings.

Coreless Induction Furnace — An electric furnace used for melting metals.

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

Core Marker — A core seat so shaped or arranged that core will register correctly in mould.

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

Core Oil — Linseed oil-base or other oil that is used as binder for baked cores.

Core Oven — Low temperature oven used for baking core.

Core Paste — A prepared adhesive for joining sections of baked core.

Core Pencil — A core projecting to centre of blind riser to admit atmospheric pressure to force out feed metal.

Core Plates/Core Drying Plates — Heat resisting plates used to support cores while being baked may be metallic or non-metallic, the latter being a requisite with dielectric core baking.

Core Puller/Core Drawing Unit — Device for extracting a metal core from the casting prior to ejection.

Core Fixing — Action of maintaining a core in position by means of an anchor pin.

Core Powder — A sand bonding agent formed from soluble starch treated to give high moisture absorption properties.

Core Pin — Elongated metal core, generally in cylindrical form.

Coreprint — Projections attached to pattern in order to form recesses in mould at points where cores are to be supported.

Core Raise/Cut-Off — A casting defect caused by floating of core towards cope surface of mould causing variation in wall thickness.

Core, Ram-Up — A core inserted into pattern and rammed up in mould.

Core, Ram-Up Wing — A core used to form projection on a side of casting. The core print is wedge-shaped and extends to parting line.

Core Relieving — The act of easement of core or core iron to avoid strain, hot or cold cracking in casting.

Core, Right and Left Hand — Core made in separate whole boxes, alike in all respects excepting that projection and bevel are on opposite sides.

Core Sag — Decrease in height of core, usually accompanied with an increase in width, as a result of insufficient green strength of sand to support its own weight.

Core Sand — Sand that is suitable for making cores, usually low in clay substance.

Core, Sectional — A core made in two or more parts and pasted or wired together.

Core Setting — Operation of placing cores in a jig or mould.

Core Setting Jig — Device permitting position of cores in the mould to be checked.

Core Shift — A variation from specified dimensions of a cored section due to change in position of core or mis-alignment of cores in assembling.

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

Core Splash — A core generally used in drag to restrain and guide molten-metal as it enters mould, thereby preventing undue tendency towards washing mould surface.

Core Sprayer — A device for spraying coating on cores.

Core, Stop-Off — A core used to simplify parting line of pattern; that is, to make it unnecessary to carry parting line above or below its normal position in order to provide for lugs or cored holes.

Core Shooting — Ramming the moulding material in a core box, by means of predetermined quantity of compressed air.

Core Shop/Core Room — Department of the foundry in which cores are made.

Core Strickle (Templet) — Device of wood or metal to give shape to certain types of cores or moulds.

Core, Superimposed — A core placed upon and rammed-up with pattern.

Core, Suspended — A core having core seat so formed that it may be suspended from above the mould.

Core, Umbrella — A core used in either cope or drag to form an internal or external surface, and one face of casting.

Core Vents — A wax product, round or oval in form, used to form vent passage in core. Also refers to metal screen or slotted piece used to form vent passage in core box employed in core blowing machine.

Core Wash — A suspension of fine clay and/or graphite applied to core to improve cast surface of cored portion of casting.

Core, Wing — A core used to form hole through casting. Coreprint is wedge-shaped and extends to parting line.

Coring — Variable composition in solid-solution dendrites; the centre of dendrite is richer in one element, as shown by pertinent solidus-liquidus lines in phase diagram

Coreless Induction Furnace — Furnace in which the secondary circuit is made up by the metal charge and possibly by the crucible, the latter than being made of a conductive substance.

Coremaker — A craftsman (or craftswoman) skilled in the production of cores for foundry use.

Core Making — Production of cores.

Corner Blowhole — Cavity in re-entrant angle of casting extending toward the interior. Their edges are generally rounded, differing in this respect from corner of fillet shrinkage.

Corner or Fillet Shrinkage — A cavity which emerges to the surface in re-entrant angles of the casting, at gates, or at surface locations characterized by slow solidification. The walls of the cavities are rough and most often dendritic, save for certain eutectic alloys.

Corner Scab — Compact and irregular projections on large portions of the casting, having the appearance of a fracture and containing numerous sand inclusions.

Corrosion Resisting Cast Steels — Corrosion resisting steels with 17 to 21 percent Cr and 8 to 10 percent Ni for which intercrystalline corrosion test can be specified.

Corundum — Native alumina, or aluminium oxide (Al_2O_3), occurring as rhombohedral crystals and also in masses and various coloured grains. Applied specifically to non-transparent kinds used as abrasives. It is the hardest mineral excepting diamond. Corundum and its artificial counterparts are abrasives especially suited to the grinding of metals.

Coupon — A piece of metal, either cast separately or attached to casting, used to determined the desired properties of casting.

Counter Plunger — In vertical cold chamber

machines, the counter plunger is fitted straight up in the bottom portion of the shot sleeve (Fig. 37). Its purpose is two fold:

a) Close the feeding port of the sprue bushing prior to injection to prevent the metal from flowing into the mould by gravity; and
b) Dissociate the excess metal from the sprue prior to opening of the mould.

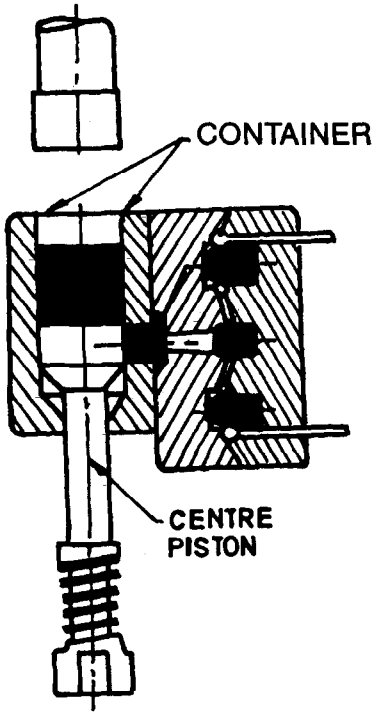


FIG. 37 COUNTER PLUNGER

Coupling — A device that serves to couple or connect the ends of adjacent parts or objects whilst in motion.

Cover Die/Fixed Die/Fixed Die Half — Part of the mould mounted on the fixed platen of the moulding machine.

Covering Flux — *See* 'Anti-piping compound'.

Crab — A carriage that runs perpendicularly to an overhead travelling crane and carries the load.

Crane/Jib Crane — A cantilever lifting apparatus fitted with jib, and comprising one or several hoist eyes or several grabbing devices such as grabs, electromagnetic lifting appliances and the like.

Cristobalite — Allotropic form of silica, stable from 1 470°C up to melting point 1 725°C.

Critical Solidification Rate of Cast Iron — Rate of solidification, above which cast iron exhibits a white structure whereas if solidified at a lower rate it would exhibit a grey structure.

Critical Temperature/Transformation Temperature — Temperature at which occurs a change in phase of an alloy either being on heating or on cooling.

A_1 : equilibrium temperature 'austenite' 'ferrite' + 'cementite' in eutectoid steel. Following symbols may be used:

Ae_1 : equilibrium temperature of the transformation;

Ac_1 : the temperature at which austenitic begins to form during heating; and

Ar_1 : the temperature at which austenite is completely transformed during cooling.

A_3 : equilibrium temperature 'austenite' ⇌ 'ferrite' in hypoeutectoid steel. Following symbols may be used:

Ae_3 : equilibrium temperature of the transformation;

Ac_3 : the temperature at which transformation of ferrite to austenite is complete during heating; and

Ar_3 : the temperature at which austenite begins to transform to ferrite during cooling.

A_{cm}: equilibrium temperature 'austenite' ⇌ 'cementite' in hypereutectoid steel. Following symbols may be used:

Ae_{cm} : equilibrium temperature of the transformation;

Ac_{cm} : the temperature at which the solution of cementite in austenite is completed during heating; and

Ar_{cm} : the temperature at which cementite precipitation from austenite starts during cooling.

A_4 : equilibrium temperature 'austenite' ⇌ 'delta iron (ferrite)'

Ar_4 : the temperature at which delta iron is completely transformed to austenite on cooling.

M_s : temperature at which the transformation of austenite to martensite starts on cooling.

M_f : temperature at which the transformation of austenite to martensite is substantially completed on cooling.

Critical/Transformation Temperatures of Pure Iron

Ac_3 (909-911°C) : transformation on heating;

Ac_4 (1 392-1 401°C) :	transformation on heating;
Ar_3 (898°C) :	transformation on cooling.
Ar_4 (1 401-1 392°C) :	transformation on cooling;

Crack (Hot Tear) — A rupture occurring in casting at or just below solidifying temperature due to internal stresses set up by shrinkage at the time of solidification.This mostly occurs at the junction of thick and thin sections.

Cracking Strip — A fin of metal moulded on the surface of casting to prevent cracking.

Crib — Network of metal used to support cope when no cope flask is used.

Cross — Device used for lifting and binding large loam moulds.

Cross Bar (1) — A cross-member, conveying to the various sections of the mould the clamping stresses of the tie rods bearing against its ends.

Cross Bar (2) — Flat or tapered crossbar integral with the two opposite sides of part of a box, to improve its rigidity. It maintains the sand in position and also consolidates it as well as fulfilling certain other functions during moulding.

Crucible — Vessel in which melting and high temperature reactions take place.

Crucible Furnace — Combustion-heated melting furnace in which the material is contained and melted in a crucible.

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

Crush Strip (Crush Bead) — An indentation in parting line of pattern plate which ensures that cope and drag shall have good contact by producing a ridge of sand which crushes against the other surface of mould or core.

Crystal — Homogeneous particle in which the atoms are arranged in the three dimensional periodic pattern.

Cupola — A cylindrical furnace normally lined with refractories for melting metal in direct contact with fuel by forcing air under pressure through tuyeres (*see* Fig. 16).

Cupola Body/Cupola Shaft — Cylindrical part of a cupola furnace between the tuyeres and the throat (*see* 2 of Fig 16).

Cupola Block — A special form with radially-shaped ends and circumferential inner and outer dimensions.

Cupola Bottom (Cupola Sand Bottom) — Layer of sand with clay rammed on bottom doors of the cupola to form sloping hearth or crucible bottom (*see* Fig. 16).

Cupola Drag — Device for pulling refuse from under cupola after melting has been completed and bottom dropped.

Cupola Drop — The sand bottom, bed and unmelted charge dropped from cupola at the end of a heat. The process is known as 'dropping the bottom'.

Cupola Charging Machine — Equipment for transporting raw materials and charging the cupola.

Cupola, Drop Bottom — Cupola equipped with hinged doors on bottom.

Cupola Dust Arrester — A device attached to the stack of cupola which removes dust and sparks from outgoing gases.

Cupola, Hot Blast — A cylindrical furnace normally line with refractories, for melting metal in direct contact with fuel by forcing preheated air under pressure through tuyeres. Unlined hot-blast cupolas are of water-cooled type.

Cupola Lighter — An oil or gas-fired torch or electric lighter used for igniting cupola bed.

Cupola Runner Trough/Launder/Spout — Inclined channel in the form of a trough, fitted with a refractory lining and situated in front of the tap hole (*see* 9 of Fig. 16).

Cupola Shell — The outer steel wall of a cupola.

Cupola Stack — The overall top column of the cupola from the charging floor to the sparks arrester (*see* 8 of Fig. 16).

Cupola Tender — Person responsible for operating a cupola.

Cupola Well — The lower part of the cupola which contains the molten-metal.

Cupola Water-Jacketed — A cupola in which the melting zone and/or tuyeres are cooled by water flowing through jackets or steel tubing.

Cured Core/Baked Core — *See* 'Baked core'.

Cuts/Wash — Irregular, generally rough projections on the surfaces of a casting, usually in the vicinity of gates or on the drag surface in line with a gate or extending along the course of metal flow in the mould cavity.

Cut the Runner System — Abridged expression for cutting in the mould sand all or part of the runner system.

Cutting Over Sand — Manual process of turning sand by shovel to obtain uniform mix.

D

Dam — Local excerscence at the bottom of a conduit across the flow of liquid or other fluid: occasionally used in the bottom of pouring basins to give rise locally to an upward motion of the alloy (*a*) (*see* Fig. 38)

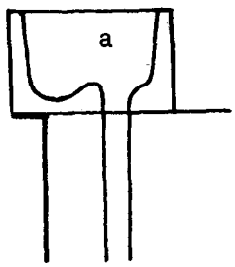


FIG. 38 DAM

Dam-Type Lip Ladle — Ladle with a refractory barrier that prevents the ingress of slag into the spout (*see* Fig. 39).

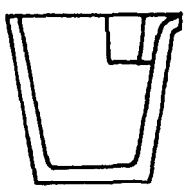


FIG. 39 DAM-TYPE LIP LADLE

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

Deaerating — Removing the air bubbles held in the underfaces of the stacked patterns.

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

Dead Steel (Killed Steel) — A steel which is quiet in mould after teeming is completed. This steel is fully deoxidized.

Deformation — A change in linear dimension due to applied load.

Degasification — Usually a chemical reaction resulting from compound being added to molten-metal to remove gases from metal. Often inert gases are used in this operation.

Degasifier — A material employed for removing gases from molten-metal and alloys.

Degree of Ramming — Degree of compression of sand after ramming.

Delivery — Draft or taper in vertical element of patterns.

Delivery Pressure — Pressure of the hydraulic fluid at the outlet of the machine's pump.

Delta Iron — The allotropic form of iron, which exists between about 1 400°C and the melting point of the metal, and has a crystalline structure similar to alpha iron, that is the body centered cubic form.

Densener — Metal component of comparatively small size inserted in a sand mould, either on or inside the cavity, to increase the cooling rate of the metal when brought into contact with the letter.

Dendrite — A crystal with a fire-free structure formed by initial freezing from a nucleus of primary branches followed by the formation from these of secondary branches at intervals so that a crystal skeleton is formed.

De Lavaud Process — A centrifugal process employed chiefly for making cast iron pipes.

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

Deoxidize — Either decreasing the oxygen content of or removing oxides from a molten pool.

Deoxidation — Removal of excess oxygen present in molten-metal in the form of oxides, usually accomplished by adding materials with a high affinity for oxygen.

Deoxidizer/Deoxidizing Agent/Deoxidant — A material used to remove oxygen or oxides from molten-metals and alloys.

Dephosphorization — Elimination of phosphorus from molten steel.

Deslagging — Operation leading to the elimination of slag formed in a cupola furnace.

Desulphurizer — A material used to remove sulphur from molten-metal and alloys. Also, a form of holding ladle or basin in which molten-metal and desulphurizing material are brought into contact.

Desulphurizing — Removal of sulphur from the molten-metal by addition of suitable compounds.

Dewaxing — Process of melting out expendable wax pattern from investment mould by application of heat at temperatures less than 120°C.

Dextrin — Soluble gummy carbohydrate formed by decomposition of starch by heat or enzymes; it is used in core and mould washes and other mixtures requiring high dry compressive strength.

Dezincification — Corrosion of brass dissolving predominantly zinc.

Diaphragm — A porous separator dividing electrolytic tank in two compartments; the portion of electrolyte in the anodic cell is known as anolyte, this in the cathodic cell as catholyte.

Die — Permanent mould made of metal.

Die Base — The upper component of a machine that bears the stresses whilst in operation.

Die Casting/Pressure Die Casting — In this process, the molten-metal is poured through a suitable device into a permanent mould (which may be cooled) at a pressure much higher (100 to over 1 000 bar) than that obtained in low-pressure or gravity die casting.

Die Casting Die/Pressure Casting Die — Metal mould designed for pressure die-casting (*see* Fig. 4).

Die Casting Growth — Expansion of casting as a result of ageing or of network corrosion of the die or both.

Die Coat — Refractory coat applied to dies prior to casting.

Die Erosion — By die casting grooves and roughness condition over sections of the surface, generally in re-entrant angles.

Dielectric Core Baking — Heating cores to baking temperature by means of high frequency dielectric equipment particularly adopted to thermosetting resin core binders.

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

Differential Hardening/Differential Quenching — Quenching so carried out that the hardness of various parts of casting differs.

Diffusion — Movement of molecules within a solution. The net movement is usually in the direction from regions of high concentration toward regions of low concentration in order to achieve homogeneity of the solution, which may be a liquid, solid or gas.

Dike — It is a type of seal that minimizes fins by creating static back pressure between seal and core cavity when core is blown.

Dilatometer — An instrument for measuring expansion or contraction caused in metal or sand sample by change in temperature or structure.

Dimension — Number expressing in a particular unit the numerical value of a length.

Diode — A biased two-electrode semiconductor device which lets the current flow through it in only one direction.

Dip Coat (1) — Dip coating of suitable viscosity applied to disposable patterns or cores.

Dip Coat (2) — A blend of refractory wash of suitable fixed particle size and viscosity in suspension in a liquid binder that hardens either chemically or thermally.

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

Direct Arc Furnace — Furnace in which the electric arc sparks between the electrodes and the metal charged.

Directional Ingate — Gate designed so that the metal penetrates in the cavity in a given direction, selected, in general, to prevent the stream of molten- metal from impringing against a wall of the cavity.

Directional Solidification — Solidification taking place very gradually from one part to another of the casting in a given direction, usually lengthwise.

Dirt Trap (Dross Trap or Slag Trap) — A device incorporated into the running and gating system, where necessary, to prevent dirt entering the mould with metal stream.

Dispersion (Deflocculation) — Separation of scattering of fine particles in a medium generally used in connection with the fineness test of clay.

Disappearing Filament Pyrometer — A pyrometer in which the temperature of a heat source is measured by equalizing the brightness of a standard incandescent-lamp filament with that of the heat-source focussed to coincide with the filament disappeared.

Discharge Hole/Plug Hole/Bottom Door — Opening provided in the bottom of a container or item of foundry equipment and through which materials in its interior can be discharged.

Distribution, Sand Grains — Variation or uniformity in particle size of sand aggregates.

Dismantle a Mould — To separate the different parts of a mould to facilitate stripping.

Dispersed Shrinkage — Narrow cavities resembling tears or fissures, generally perpendicular to the surface of the casting. The internal surface of these cavities is dendritic.

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

Divorced Cementite/Spheroidized Cementite —The globular condition of iron carbide after a spheroidizing treatment.

Dobie — A moulded block of ground clay, usually crudely formed.

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

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

Double Contraction Pattern — Pattern to be duplicated by moulding. The first contraction compensates that of the copied-pattern's alloy, and the other that of the alloy of the casting required. The dimensions of the double-contraction pattern cover both contractions.

Double Skin/Shell/Shaling — Thin layer of metal covering some areas of the casting and attached to the casting only in few points. The composition differs generally of the composition of the casting.

Dowel/Dowel Pin — Metallic part, integral with one of the elements of an assembly, for guiding two elements into their relative position.

Down Sprue/Downgate Sprue — Downward channel below the pouring basis or pouring bush whereby the molten-metal flows into the mould (*a*) (Fig. 40).

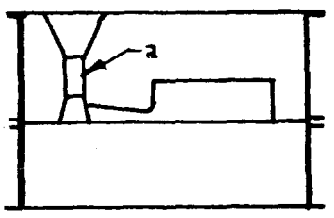


FIG. 40 DOWN SPRUE

Draft (1)/Taper/Draught — Slope of wall relative to the direction of stripping so that this operation is made easier; in a broader sense this term also refers to mould assembly and relates to the walls of patterns, core boxes, mould cavities or rough castings. The draught of the walls of rough castings is to be consistent with the finished machine drawing.

Draft (2) — Current of air or gas in a duct or furnace created by a difference of pressure.

Drag — Lower or bottom section of a mould or pattern.

Drag Box — Box specially designed to make up the bottom part of a mould.

Drag Link Conveyor/Drag Bar Conveyor/Scrapper Conveyor — A conveyor having one or more chains equipped with scraper bars and operating in a trough (Fig. 41).

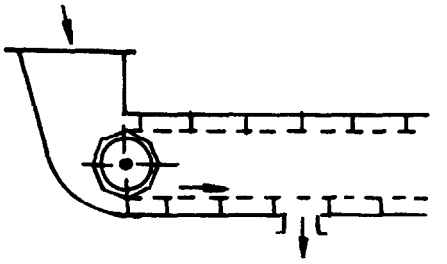


FIG. 41 DRAG LINK CONVEYOR

Draw — A term used to denote a shrinkage appearing on the surface of a casting or a riser.

Draw Back — A section of a mould lifted away on a plate or arbor to facilitate removal of pattern.

Draw Bar — A bar used for lifting the sand mould.

Drawing — Removing pattern from mould or mould from pattern in production work.

Draw (Pattern Draw) — Taper given on the pattern for easy removal from the mould.

Draw on Pins — To draw the mould by raising it on four draw pins.

Draw on Rollers — To draw the mould by raising it on two parallel lines of rollers supported on the edges of the moulding box.

Draw Peg — A wooden peg used for drawing patterns.

Draw Piece — Removable part of the core box, removed through one side before the core is removed.

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

Draw Spike/Rapping Spike/Rapping Pin — Pointed metal pin used for rapping and removing small patterns after having stuck it into the wood of the pattern.

Drawing Machine/Stripping Machine/Pattern Draw Machine — Machine used particularly for stripping a pattern or a core.

Drawing of Rough Casting — *See* 'Casting drawing'.

Dried Sand — Sand which has been dried by a mechanical drier prior to use in core making.

Drop (1)/Sticker — Irregular massive projection on the cope surface of the casting whose appearance suggests detachment of a part of the mould wall. The defect is usually accompanied by the presence of sand inclusions or missing material in the casting surface.

Drop (2) — A mould defect caused by sand dropping from the cope or other overhanging section.

Drop Ball — A heavy weight usually spherical or pear-shaped, which is dropped from a height to break large pieces of castings.

Drop-Off (Drop-Out) — Sand falling from cope of a mould.

Drop-Mould Brick/Drop-Machine Brick — Brick formed by dropping a clot or slug of prepared mixture a height of approximately 5 m into a mould.

Droplet — Liquid substance particle, apt to remain in suspension in a gas. In a cloud, its diameter may reach 200 μm.

Dross — Metal oxides in or on the surface of molten-metal.

Dross Filter — Filter consisting of a sieve, perforated metal sheet, steel wool, etc, positioned in the gate so as to collect the slag of the molten-metal.

Dry Fineness — Fineness of a sample of foundry sand which has been dried at 105°C to 110°C.

Drying Oils — Vegetable or animal oils which are easily oxidized by exposure to atmosphere and which hasten the drying action of core oil to the desired extent.

Dry Permeability — The permeability of moulded mass of sand, bonded or unbonded, dried at 105°C to 110°C and cooled to room temperature.

Dry Sand Mould — A mould from which moisture has been removed by suitably heating the mould prior to pouring molten-metal into it.

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

Dry a Core — To heat a core and maintain it at a suitable temperature for a sufficient time to ensure hardening of the binder.

Dry Sand — Abbreviated expression to denote the sand of a stoved mould.

Dry Sand Core — Core made in sand agglomerated with clay in sufficient proportion to obtain high strength after drying.

Dry Scrubbing — A method of reclamation, by which the sand previously reduced to grains, is projected by an air current against a target so as to remove the residual binder, the effect is obtained both by the impact of the grains on the target and on one another.

Dryer — Apparatus used for drying.

Dual-Radiation Pyrometer — A radiation pyrometer utilizing two bandwidths of the spectrum emitted by the heat source, and whose radiant energy differential is used to measure temperatures.

Ductile Cast Iron/Nodular Graphite Cast Iron/ Spheroidal Graphite Cast Iron — Cast iron containing graphite in the form of substantially spheroidal particles produced by suitable molten-metal treatment and not by heat treatment.

Ductile Fracture — Break occurring after a generally plastic deformation.

Ductility — The property permitting permanent deformation without rupture in a material by stress in tension.

Dull Iron — Cast iron not so hot as it should be used for pouring.

Dump Box — Container to hold the sand mixture for shell moulding, having an open end to receive the hot pattern plate which becomes covered with sand as the box is inverted.

Dump Bucket — A box or other receptacle for carrying material, so arranged that the contents may be discharged easily and rapidly.

Dune Sand — Wind blown deposits of sand found near large bodies of water.

Duplex Process/Duplexing — A method for producing molten-metal, the load being melted in one furnace and refined in another.

Durability — Retention of the properties inherent in warmed-up clay. Durability is determined by the temperature that brings about the loss of the water of constitution.The clay-regenerating content of a sand is hence directly related to durability.

Durville Casting — Process consisting initially in pouring the molten-metal into a tilted mould and progressively righting same as filling proceeds.

Durville Process — A casting process that involves

rigid attachment of mould in an inverted position above crucible. The melt is poured by tilting the entire assembly, causing metal to flow along a connecting launder and down the side of mould thus eliminating dross entering mould.

Durville Pouring — Pouring executed in such a way that the liquid metal fills up the mould progressively, without turbulence.

Dust — Finely powdered matters which can be suspended in air or other gas.

Dust Arrester/Dust Filter — Equipment for removing dust from air in ventilation or exhaust systems.

Dust Removal/Dust Catching

a) Operation consisting in removing dust.
b) Result of that operation.

Dwel Time — In pressure die casting, the period allowed for a metal shot to remain in a die before opening the machine.

E

Eddy Currents — Local currents induced in a conducting body.

Ejector Box/Ejector Die — A fixture attached to die casting machines, housing a plate, that carries a series of small diameter pins which eject the casting from the moving die-side after the mould has commenced to open.

Ejection Lug — Attachment added to the casting to permit the use of ejectors situated outside of the casting.

Ejection Plate/Top Ejector Plate/Upper Ejector Plate — Plate supporting the ejectors and return pins (*see* 18 of Fig. 4).

Ejector Pin — Rod, generally cylindrical, which passes through the moving die, comes flush with the mould cavity and by its movement ejects the castings from the mould (*see* 16 of Fig. 4).

Ejector Plate Stop/Ejector Plate Rest/Stop Button — Device which combined with the return pins ensures the precise positioning of the ejection plate when the mould is closed (*see* 21 of Fig. 4).

Ejector Sleeve — Hollow ejector, bearing against a portion of the cored casting, such as, for example, a hollow boss (*see* 17 of Fig. 4).

Elastic Deformation — Temporary change in dimensions caused by stress. The material returns to the original dimensions after removal of the stress.

Elasticity (Modulus of)/Young's Modulus/ Coefficient of Elasticity — The ratio of stress to strain within the elastic range; the modulus of elasticity in tension or compression (E) is also known as Young's modulus and that in shear as the modulus of rigidity. F being the applied load, S the area of the cross-section of the test piece. Δl the elongation, l the initial gauge length.

$$E = \frac{(F)}{S} \Big/ \frac{(\Delta l)}{l}$$

E is expressed in newtons per square millimetre. The modulus of elasticity may be constant up to a value of the stress referred to as 'limit of proportionality' its value being equal to the slope of the straight part of the stress-strain diagram.

Electric Arc Furnace — Electric furnace in which the calorific emission results from the formation of an electric arc.

Electric Furnace — A furnace for industrial purposes, either for melting or for heat-treating, the source of heat being electric current.

Electric Furnace, Direct Arc — An electric arc furnace in which the metal that is being melted is used as one of the poles.

Electric Furnace, Indirect Arc — An electric arc furnace in which the metal bath is not used as one of the poles of the arc.

Electric Furnace Iron — Pig iron proceed or refined in a electric furnace.

Electric Induction Furnace — Furnace in which the calorific emission is produced by the effect of induction currents in the material itself (eddy currents).

Electric Resistor Furnace — Furnace in which resistors radiate heat.

Electric Resistance Furnace — Furnace in which the calorific emission is produced by Joule effect in resistances.

Electrode — Compressed graphite or carbon cylinder or rod used to conduct electric current in electric arc furnaces.

Electrode Nipple — Threaded fitting of same material as the electrode for connecting two elements of same.

Electrolytic Copper — Electrolytically-refined copper, the copper content being of at least 99.90 percent (plus some silver).

Electromagnetic Agitation — A stirring action created by a rotating magnetic field, usually in induction melting.

Electron Beam Furnace — Furnace in which metal is melted in a vacuum in its crucible by direct impingement of a high-power stream of electrons.

Elephant Skin/Laps — *See* 'Cope defect'.

Elevator — Machinery which provides the continuous or semi-continuous transport, vertically or up a steep slope, of loads or materials.

Embedded Core/Ram-Up Core/Superimposed Core — A core whose prints are captive within the sand during the mould-making process.

Emission — From a source, admission of solid, liquid or gaseous substances propagated by radiation.

Endothermic Reaction — Designating, or pertaining to a reaction which occurs with absorption of heat from the surroundings.

Endurance Limit (Conventional) — One half of the maximum range of alternating stress or maximum range of repeated or undulating stress which a material will withstand a specified number of applications.

Endurance Ratio — The ratio of endurance limit to ultimate strength.

Engineering Cast Iron — Cast iron normally used at ordinary temperature, because of its mechanical properties, hardness and resistance to wear.

Environment — At a given time, general unit of physical, chemical and biological agents an social factors apt to have a direct or indirect, immediate or dated effect on the living organisms.

Epoxy Resin — Resin used for making patterns and core boxes. A mixture of resin and hardener that chemically sets at room temperature.

Equiaxed — Crystals exhibiting similar dimensions in all directions.

Equilibrium Diagram/Phase Diagram — Graphical representation of the stability fields of the phases of a category of alloys, as a function of composition, temperature, and in certain cases pressure.

Equipment/Plant/Facility — The machinery and tools used in manufacturing a product or for providing service.

Erosion Scab — Massive rough, irregular layers of excess metal, generally with sharp edges, parallel to the surface of the casting and having very rough surfaces They are generally attached to the casting only at a few points and can be detached by means of a chisel : however the areas of attachment to the casting remain evident and an underlying depression persists.

Etch — To roughen the surface of a metal by selective dissolution. The solution used for etching is called etch or etchant.

Ethyl Silicate — Resin-like compound $Si(C_2H_5O)_4$; (melting point: 77°C; boiling point 168°C) that yields by hydrolysis and a small amount of hydrochloric acid, a gelatinous silica featuring an effective binding property for the sands and refractories used in lost-wax and ceramic moulding processes. Commercially available, for industrial applications, in a solution of denatured alcohol (ethyl silicate 57 percent, alcohol 35 percent, water 8 percent).

Eutectic — Alloy or constituent which is the product of two or more finely scattered phases and whose composition is such that it undergoes or has undergone the eutectic transformation.

Eutectic Carbide — Carbide formed during freezing as one of the mutually insoluble phases participating in the eutectic reaction of ferrous alloys.

Eutectic Iron — Iron, the composition of which is approximately equal to the eutectic composition (carbon equivalent equal to 4.3).

Eutectic Reaction — Isothermal reversible reaction of a liquid that forms two different solid phases (in a binary alloy system) during cooling.

Eutectic Temperature — The temperature at which a eutectic either melts or solidifies.

Eutectoid — Alloy or constituent which is the product of two or more finely scattered phases and whose composition is such that it undergoes or has undergone the cutectoid transformation.

Eutectoid Steel — Steel constituted only by pearlite when it is in the annealed state.

Eutectoid Transformation — Reversible transformation of one solid phase into two solid phases.

Evacuated Die Casting/Vacuum Die Casting — Variant of pressure die casting consisting in evacuating the mould cavity prior to pouring.

Evaporation Coating — Plating or metallizing by high vacuum evaporation based on the principle that metal vaporized in a vacuum chamber deposits on cold objects in the same chamber without oxidizing. This retains bright metallic lusture in the deposited thin film.

Exchangeability of Bases — Proportion of exchangeable basic oxides matching the cations absorbed at the surface of the laminations of a clay.

Exhaust System — An arrangement of ducts or pipes and fans removing objectionable dust, heat and pollutants from one or more points or from a process and then discharging them into the atmosphere.

Exothermic Breaker Core — Breaker core of exothermic material (*a*) (Fig. 42).

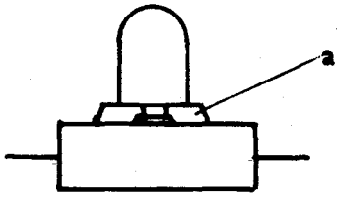


FIG. 42 EXOTHERMIC BREAKER CORE

Exothermic Reaction — Chemical reaction involving the liberation of heat; such as burning of fuel, deoxidizing of iron with aluminium, and a characteristic of many feeder or riser compounds.

Exothermic Sleeve — Sleeve of exothermic material the inner portion of which conforms to the cylindrical portion of the feeder head.

Expanded Polystyrene — A hydrocarbon-based polymer, the foam material used for making the patterns is derived through two successive actions of a blowing agent and is supplied, in the form of panels, in a wide range of densities and sizes.

Expansion Scab — Irregular metallic projection of several millimetres thickness, generally with sharp edges, parallel to the surface of the casting and having very rough surfaces.They are generally attached to the casting only at a few points and can be detached by means of a chisel: however the areas of attachment to the casting remain evident and an underlying depression persists.

Extensometer — An instrument used in the testing of metals to measure small increments of length especially during a tensile test.

F

Facing Powder — Non-adhesive, facing compound powdered over the cavity of a sand mould, to prevent entry of the molten-metal either after replacing the pattern in the mould or bushing over the core to ensure proper penetration and adhesion.

Facing Sand — Specially prepared moulding sand mixture used in the mould adjacent to the pattern to produce a smooth casting surface.

Fading — Progressive reduction and, eventually, disappearance of one or more property previously imputed to the alloy via an appropriate treatment.

Fash (Burr) — Sharp and ragged edges left after shearing or sawing.

Fat Sand/Strong Sand — Sand having good cohesion which is generally the result of a high clay content.

Feather-Edged Brick — A brick modified so that one of large faces is inclined from one side to the opposite side (Fig. 43).

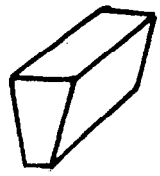


FIG. 43 FEATHER-EDGED BRICK

Feed — To supply the amount of molten-metal needed to maintain the cavity full during solidification of the casting.

Feed Chute — A trough-shaped device used to convey a flow of materials.

Feeder (Feeder Head) — A reservoir of molten-metal to compensate for the volume shrinkage of metal as it solidifies. Molten-metal flowing from the feeder, also known as riser, prevents voids in the casting.

Feeder Head Gating/Riser Gating — Gating arrangement whereby the feeder head cavity is heated while filling the mould and may thus be conducive to increasing efficiency of such filling.

Feeder Head Height/Riser Height — It is vertically largest dimension.

Feeder Head with Washburn Core — Feeder head the main diameter of which is definitely larger than its feeding neck (*a*) (*see* Fig. 44).

Feeder Neck/Riser Neck — The connecting passage between the feeder and casting (*a*) (Fig. 44).

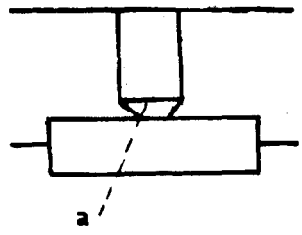


FIG. 44 FEEDER NECK

Feeder Pad/Riser Pad — An enlargement of the feeder neck where it joins the casting. The purpose of the pad is to prevent the feeder from breaking into the

casting when it is struck or cut (*b*) (Fig. 45).

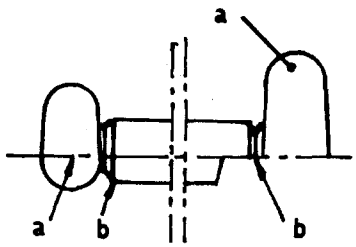


FIG. 45 FEEDER PAD

Feeding (1) — Pouring additional molten-metal into a freshly poured mould to compensate for volume shrinkage while the casting is solidifying.

Feeding (2) — The continuous supply of molten-metal, as from a riser, to the solidifying metal in the casting. Refers to keeping risers open by manipulation of feeding rods.

Feeding Distance/Feeding Zone — Distance, within a casting measured from the edges of the feeder head over which the feeding is effective.

Feeding Rod — An iron rod used for keeping open the head or feeder, to which hot metal is added from time to time as the casting contracts in cooling.

Feeding System — The system whereby the casting is supplied with molten-metal while the latter is cooling down.

Ferritic Cast Iron — Cast iron with matrix constituted of ferrite.

Ferritic Malleable Cast Iron — Malleable cast iron with matrix constituted of ferrite.

Ferritic Steels — Steels in which ferrite is the predominant phase. These steels are magnetic.

Ferro-Alloy — Iron-based alloy with one or several other elements. As a rule introduced into a furnace or into molten iron or steel to increase the content of these elements or to act as a deoxidant or an innoculant.

Fettling — *See* 'Chipping-out'.

Fettling Shop — Shop where fettling is carried out. This term is sometimes extended to cover the operations of deadhead removal and dressing.

Fettling Tool — Tool used to remove gates and fins after casting.

Fettling Wheel — An abrasive wheel used for fettling castings.

Fibres Glass Cloth — Cloth, mat, roving and fibres made of glass used as reinforcing material with epoxy resins.

File Hardness — Metal hardness determined by a set of files of graduated hardness.

Filler Sand — *See* 'Backing sand'.

Fillet — Concave corner piece usually used at the intersection of right angled surfaces on patterns and core boxes. A struck fillet is one that is dressed to shape in place, usually of wax. A planted fillet is one made separately and affixed in place. Fillets used at re-entrant angles in cast shapes lessen the danger of cracks and avoid 'fillet shrinkages'.

Fillet Iron — Patternmaker's hand tool, with an oval head, used to exert a pressure on a leather fillet when it is being glued on.

Fillet Scab — Metallic projection; having the form of a thin blade of irregular contour located at re-entrant angles, along edges or in the vicinity of corners at a distance of 2 to 5 mm from the mould surface and parallel to it.

Fillet Vein — Thin metallic projection located at a re-entrant angle and dividing the angle in two parts.

Fillet Wax — Beeswax in the form of sheet, rod, or triangular ribbon, used for filleting patterns.

Fin — A thin projection of metal on the casting, formed as a result of imperfect mould or core joints.

Fineness, Sand — The extent of sub-division of a foundry sand as determined by the standard fineness test.

Fines — A term the meaning of which varies with the type of foundry or the type of work. It refers to these sand grain sizes substantially smaller than the predominating grain size.

Finger-Gating — Used on thin castings to allow rapid filling of mould. It is wedge-shaped with thin edge divided vertically to produce several members or fingers. Metal flows into mould in several thin streams. Facilitates distribution of metal horizontally in a mould over a wide area and breaking gate from a thin or delicate casting (*a*) (Fig. 46).

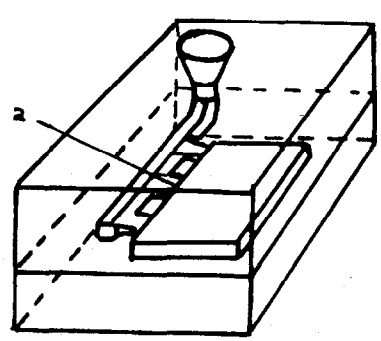


FIG. 46 FINGER-GATING

Finish — To dress a mould, that is to repair parts badly packed or damaged during removal of the pattern, to sleek, to spray, to apply coating etc.

Finish (Dull) — A finish lacking both diffuse and specular reflection.

Finish Allowance — Amount of stock left on the surface of a casting for machine finish.

Finish Mark — A symbol appearing on the line of a drawing that represents the edge of the surface of the casting indicating the type of finish, whether to be machined or otherwise finished.

Finished Casting — Casting having undergone all the operations specified on the finished-machine drawing.

Finning/Veining — A defect on the surface of a casting appearing as veins or as fins, occurring either singly or in networks not situated along parting lines.

Firebrick — A brick made from refractory clays for use in lining furnaces and other high temperature applications.

Fireclay — A clay which is resistant to high temperatures consisting of hydrated aluminium silicate.

Fire Sand — A refractory sand which resists high temperatures.

Firestone — Amorphous form of silica, commonly in the form of shear-sloping strata in chalk layers, kidned-shaped; it contains 95 percent of SiO_2.

Fixed Carbon — In coal or coke, it is an index of its fuel value calculated as follows:

$$\text{Fixed carbon, percent} = 100 - (\text{Percent volatile materials} + \text{percent ash})$$

Fixed Die/Fixed Die Half — *See* 'Cover die'.

Fixed Platen — Platen integral with the machine frame on the side off injection device.

Flash — A water of metal projecting from a casting caused by the metal entering parting lines and at the junctions of moulds and of cores.

Flash Point — The minimum temperature at which the vapour given off by the heated substance flashes on the application of a flame, according to a standardized test.

Flask — Rigid frame serving to contain and support the sand constituting part of a mould.

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

Flask Pins — Guides to assure proper alignment of the cope and drag of the mould after the pattern is withdrawn.

Flask, Slip — A tapered flask which depends to hold the sand in position on a movable strip of metal. After using the mould, the strip is withdrawn.

Flask, Snap — A moulding box of wood or metal fitted with diagonally opposed hinges and fasteners so that it can be opened for removal from the mould (*see* Fig. 47).

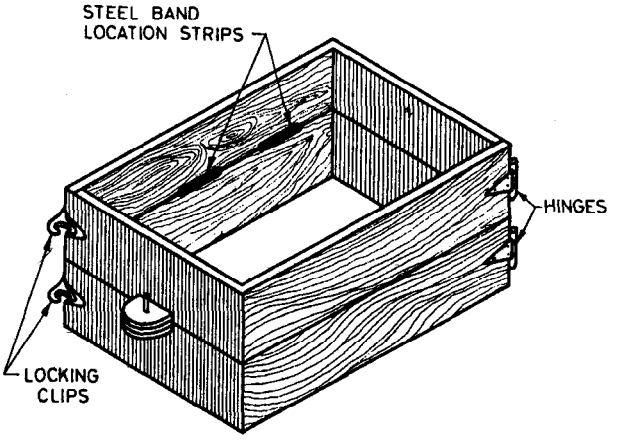


FIG. 47 SNAP FLASK

Flask, Tight — A type of flask which remains on mould during pouring. Lugs are normally provided for clamping cope and drag together for pouring.

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

Flat Gate — Flat gate the cross-section of which is, in general, rectangular.

Floating Core — Core that is not supported on both ends. It is also known as 'balancing core'.

Floor Moulding — Moulding operation carried out on the floor for very large or heavy castings.

Floor Sand — Sand collected after shaking out and as yet unreconditioned.

Flow Marks (1) — Surface defect peculiar to pressure castings, characterized by folds on the surface of otherwise sound castings and tracing the flow of the streams of liquid metal.

Flow Marks (2) — Irregularly distributed depressions, elongated or rounded in form, which generally follow the course of the liquid metal in filling dead spots in the mould or are located at areas remote from the gates. Before cleaning the depressions are filled with oxide scale.

Flow-off (1)/Run-off — Opening provided at one side or on top of the mould:

a) to allow pouring of the metal and show the level to which the mould has been filled;
b) to remove dross; and
c) to permit escape of gases.

Flow-off (2)/Run-off — To cause the liquid metal to overflow from the risers in order to remove slag and dross.

Flow Rate — Amount of fluid or molten-metal that flows per unit of time through a component of a hydraulic system, for example, a valve, a pump, etc. Also denotes the rate of filling.

Flowability — The property of sand grains to move easily among themselves and reproduce the contour of the core box or pattern.

Flue Gases — Effluent gases, results of a combustion.

Fluid Sand Moulding — A moulding process involving a cold thermosetting sand emulsified in foaming microbubbles and which, being very fluid, may be packed by pouring it. Selfdensification of the emulsion, brought about through disruption of the bubbles, is followed by hardening, and promotes excellent cohesion.

Fluidity — The ability of molten-metal to flow readily as measured by the length of a standard spiral casting.

Fluidity Spiral/Fluidity Test Piece — Test piece in spiral or rectilinear bar form, cast in determined conditions, the length of which permits the degree of fluidity of an alloy to be evaluated (Fig. 48).

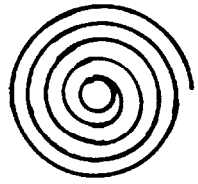


FIG. 48 FLUIDITY SPIRAL

Fluorspar — Naturally occurring calcium fluoride (CaF_2) used as a flux in basic steel making.

Flux/Fluidizer/Fluxing Agent — Substance that fluidizes a slag during a metallurgical process, by lowering its melting point.

Flux-Covering/Fluxing — A substance or compound bringing about formation of a liquid layer on the surface of a melted non-ferrous metal, the purpose being to isolate it from the environment (protective flux) or give rise to reactions within the metal, thus enhancing the properties off the latter.

Fly Ash — A finely divided product of combustion, usually oxide which may appear as inclusions in the molten-metal.

Follow Board — Stiff and ribbed metal plate, representing the mould joint of a pattern plate.

Forced Draught — Drought brought about mechanically for example, by a fan, blower, etc.

Forehearth — Reservoir jointed directly to the cupola for receiving and holding the molten-metal.

Founding — The science of melting and casting of metals into useful objects.

Foundry — A building, establishment or works where metal castings are produced.

Foundry Coke — A coke selected to fill foundry needs for melting in cupola. It should be hard, compact, in 90 to 120 mm lumps and feature the very highest Micum index M 80 possible.

Foundry Facing — Material, usually carbonaceous, applied to the surface of a sand mould to prevent the molten-metal from penetrating and reacting with the moulding sand.

Foundry Materials — Supplies and raw materials used for casting production.

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

Foundry Pig Iron — Pig iron for castings, used as is or subsequently to remelting.

Foundry Methods Drawing — This drawing shows the mould joint lines, the cores and coreprints, the gating and feeding systems, the devices for control of solidification (heating devices, denseners) and the amount of metal needed in each mould.This drawing, indicating the shrinkage allowance is the basis for tooling. Selection of all these methods, when the casting is designed, is critical to good mould design.

Foundry Returns — All runners, teeming assemblies, vents, feeder assemblies, etc, and possibly rejected parts from the foundry itself, which are charged back into the melting cycle. The return scraps are generally gathered into groups of identical chemical composition before being remelted.

Foundry Scrap — Consists of gates, sprues, risers, defective castings and borings, all of known composition, which are charged back into the melting cycle.

Foundry Service — A foundry that is a part of a manufacturing establishment.

Front Slagging — A process wherein both slag and molten-metal flow out through the tap hole.

'F' Shots — Alloy of nickel, silicon and cast iron for ladle addition.

Foundryman — Responsible person in a foundry company or shop. Also most people working in the foundry.

Fracture — The type of surface found upon breaking a piece of metal.

Framed Core Box — Box in the form of a frame, completed by a base. Such a box is generally removed to release the cores (Fig. 49).

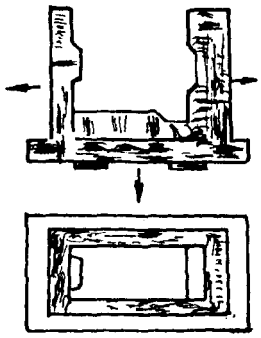


FIG. 49 FRAMED CORE BOX

Free Carbon — Uncombined carbon.

Free Ferrite — Ferrite formed from austenite during cooling, without simultaneous formation of carbide.

Frequency Meter — An instrument for measuring the frequency of an alternating current.

Friable — Easily crumbled or pulverized.

Fritted Sand — Sand heated to a high temperature to remove the binders therefrom.

Front Plate — Ring which at the extremity of the metal chill-mould forms the end of the centrifugal cast cylinder when the operation is completed.

Front Slagging — A process whereby both slag and molten-metal flow out through the tap hole. The slag is then skimmed off the surface of molten-metal by a skimming barrier.

Fuel — Material capable of releasing heat by combustion.

Fuel-Oil — Combustible in liquid form extracted from petroleum oils by fractional distillation. It is divided into the following in order of increasing viscosity: domestic fuel oil; light fuel oil; heavy fuel oil.

Full Mould Process — *See* 'Cavityless casting'.

Furan Resin — A resin derived from furan (C_4H_4O), term usually referring to foundry furfuryl-alcohol containing resins.

Furfuryl-Alcohol — A high temperature boiling liquid used to make thermosetting or self-hardening resins.

Furnace — An enclosed structure in which heat is produced for one purpose or another.

Furnace Atmosphere — Gases in contact with the metal bath during melting and holding.

Furnace Coke/Metallurgical Coke — Coke for use in blast-furnaces, adequately abrasion-resistant and of medium size.

Furnace, Continuous Annealing — A furnace in which castings are annealed by passing through different zones, each of which is kept at a constant temperature, and each of which is at a different temperature.

Furnace, Periodic Annealing — A furnace or oven in which castings are annealed by raising and lowering the temperature of the whole furnace.

Furnace, Resistance — A furnace which is heated by the resistance of electrical conductors.

Furnace, Reverberatory — A furnace having a vaulted ceiling that deflects the flame and heat towards the hearth or the surface of the charge to be melted.

Furnace Shell — *See* 'Casing'.

Furnaceman — Craftsman employed in the production of liquid metal.

Furnace, Short Anneal — Any heating unit in which the annealing may be completed in a relatively short time.

Furnace, Special Atmosphere — A furnace for annealing castings, equipped with controls for maintaining an atmosphere of definite composition surrounding the castings.

Furnace, Titling — A melting furnace that can be titled to pour the molten-metal.

Fused-Silica Brick — Brick made from fused-silica aggregates and a suitable binder.

Fusibility — Property of an alloy the melting point of which is comparatively low.

Fusible Lost Pattern — A lost-wax model that vanishes by melting.

Fusion Point — The temperature at which foundry sand or clay begins to soften.

G

Gauge Length — The specified length marked on a tensile test piece over which elongation is measured.

Gagger/Lifter — A metal piece of irregular shape (usually Z shape) used to reinforce and support sand in deep pockets of pattern.

Gangue — The earthy part of an ore, that contains no metal.

Gang Way — Passage in a foundry.

Gannister/Quartzite — A compact granular rock composed of quartz. It is a metamorphosed sandstone and siliceous cement is often so blended with the quartz grains as to give the rock a nearly homogeneous texture. Primary material in silica brick.

Gas Coke — *See* 'By-product coke'.

Gas Producer — Apparatus producing combustible gases from suitable solid fuels.

Gas Welding Process — Welding using as source of heat the flame of a burner fed with various fuel gases and combustion agents, usually acetylene burned with purified oxygen.

Gate — End of runner in mould where molten-metal enters casting or mould cavity, sometimes applied to entire assembly of connected channels, pattern parts which form them or metal which fills them, and sometimes is restricted to mean the first or main channel.

Gate, Bottom — A gate which enters the casting cavity at the bottom of the mould. It is illustrated in Fig. 50, although other variations are also used. For example, a well at the base of the sprue or a charge in the direction of flow of the metal to reduce flow rate in the system.

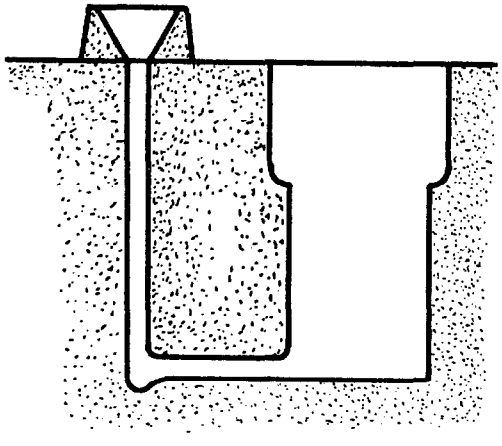


FIG. 50 BOTTOM GATE

Gate, Branch — Two or more grates leading into casting cavity. It is designed either to feed a single casting at several points or a number of individual castings (*see* Fig. 51).

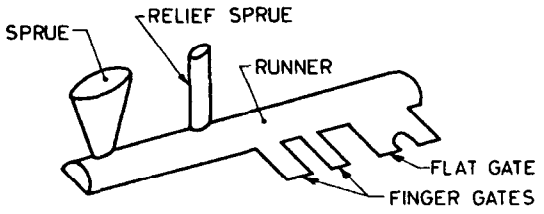


FIG. 51 BRANCH GATE

Gate Cutter — A device for cutting gates in the mould.

Gate Pattern — One or more patterns with gates or channels attached.

Gate, Finger — Gate used on thin castings to allow rapid filling of mould. It is divided vertically to produce several members or fingers. It also facilitates breaking of gate from a thin or delicate casting.

Gate, Horn — This is one type of bottom gate. It is a semi-circular gate to convey molten-metal over or under certain parts of a casting so that it will enter the mould at or near the centre; also used as a skim gate (*see* Fig. 52).

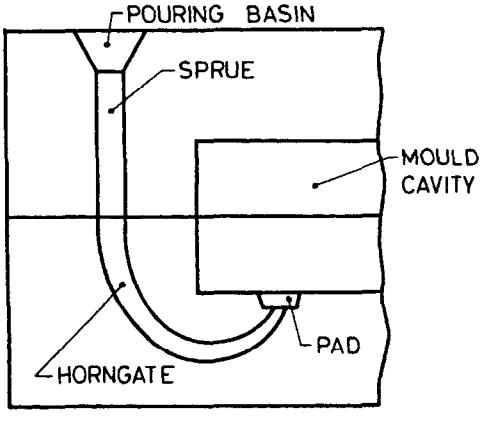


FIG. 52 HORN GATE

Gate, Horse Shoe — A gating system where a runner and two ingates are combined in the shape of a horse shoe. This system is easy to hand cut and to remove from casting (*see* Fig. 53).

Gate, Knife — A slit or opening about 4 to 6 mm thick through which metal enters mould cavity. Knife gates are usually poured or downhill tilt to provide progressive filling of mould cavity and are easy to remove (*see* Fig. 54).

Gate, Lap — A slit or opening 1.5 to 6 mm thick, usually less than 75 mm in length, formed by overlapping of runner with an edge of mould cavity (*see* Fig. 55).

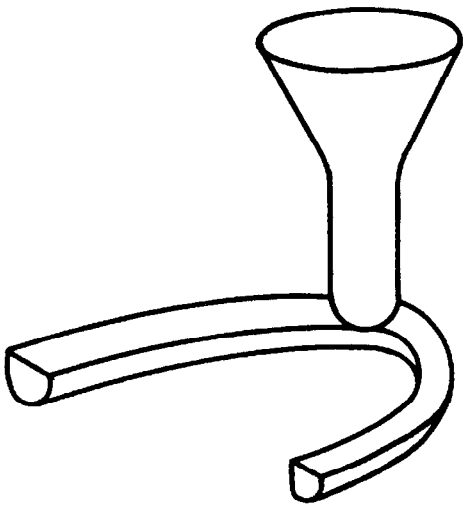


FIG. 53 HORSE SHOE GATE

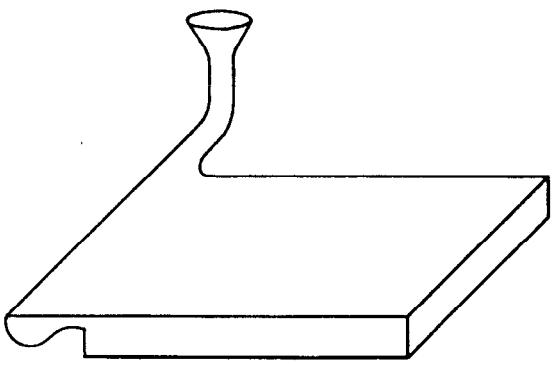


FIG. 54 KNIFE GATE

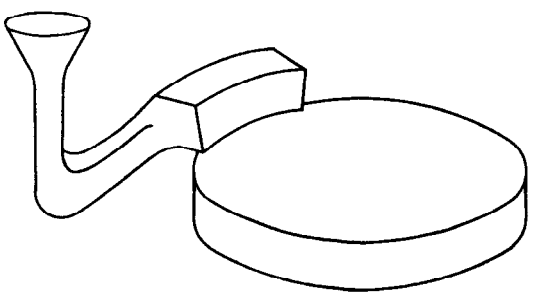


FIG. 55 LAP GATE

Gate, Parting — These gates enter the mould cavity along the parting line separating the cope and drag portions of the mould. They may contain devices such as skin bobs or relief sprues to collect dross or slag (*see* Fig. 56) or to relieve pouring pressure. Design *D* illustrates the use of a pouring basin to serve this function, while design *E* contains a shrink bob serving the dual function of slag or dross collector and metal reservoir to feed the casting as it shrinks. Designs *F* and *G* illustrate the use of core inserts to filter the metal or prevent erosion of the mould.

Gate, Pencil — A series of small round gates entering the mould cavity from above and coming from a common pouring basin (*see* Fig. 57).

Gate, Ring — A gate so formed that a number of small gates conduct the metal from a circular runner to a mould in the centre (*see* Fig. 58).

Gate, Runner — A horizontal channel for running metal into mould cavity.

Gate, Slot — A gate used on vertical cylindrical castings in which down sprey and casting are connected over a large part or all of the height of casting.

Gate, Step — A gate which allows entrance of the metal into the mould in steps (*see* Fig. 59).

Gate, Swirl — *See* 'Gate, whirl'.

Gate, Wedge — A gate of the shape of wedge feeding directly into the mould cavity (*see* Fig. 60).

Gate, Well — *See* 'Pouring basin'.

Gate, Whirl — A gate and sprue arrangement which tangentially introduces molten-metal into a riser so the centrifugal action forces dirt or slag to the centre of the riser and away from the riser connection as the metal enters the casting cavity (*see* Fig. 61).

Gating System — The complete assembly of sprues, runners, gates and individual casting cavities in the mould. Term also applies to similar portions of master patterns, pattern die, patterns, investment mould and the finished casting.

Gel — A flocculated mass of microscopic particles.

Gooseneck — In die casting, an S-shaped movable part submerged in molten bath of zinc or magnesium alloy through which metal is injected at into the die cavity.

Gooseneck Nozzle/Nose/Nose Insert — Component inserted into the gooseneck, usually detachable and used as bearing surface for the intermediate nozzle.

Grain Fineness Number — *See* 'Fineness number'.

Grain, Sand — The granular material of moulding or core sand, left after removing the clay substance in accordance with a standard test.

Grain Size — The average size of the crystals or grains.

Graphite, Primary — Free graphite sometimes precipitated in white cast iron during solidification.

Graphitiser — Any material which increases the

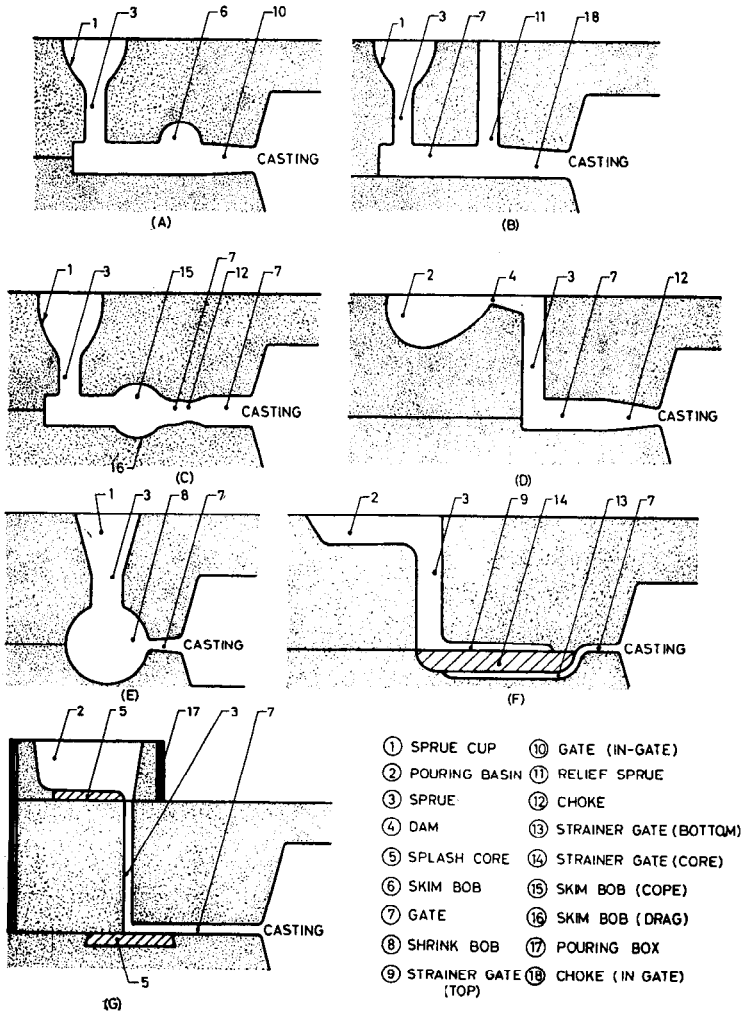


FIG. 56 PARTING GATES

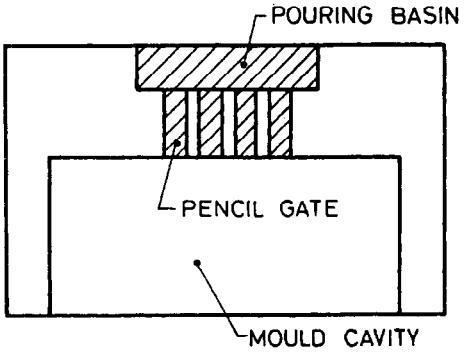


FIG. 57 PENCIL GATE

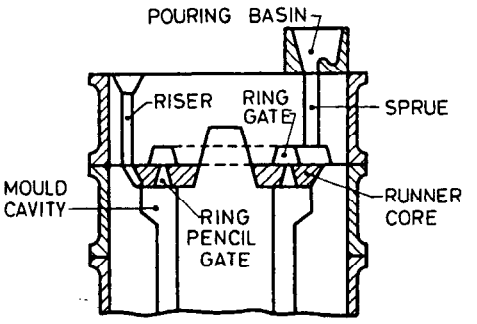


FIG. 58 RING GATE

tendency of iron carbide to break down into iron and graphite.

Graphitising — Heating and cooling in a controlled manner so as to transform the combined carbon to graphitic form (for example, free carbon) of desired size and amount.

Grate — A frame of iron bars for holding fuel while it is burning and through which all or most of the combustive air passes.

Gravity Die Casting — Process consisting in pouring the molten-metal straight into the die through a pouring basin placed on top of the same.

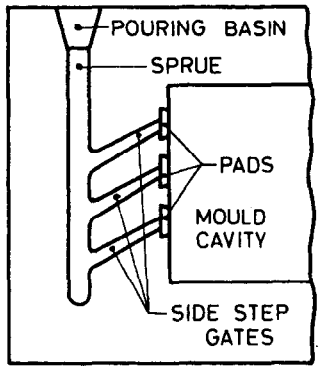


FIG. 59 SIDE STEP GATE

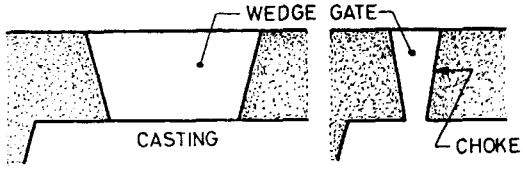


FIG. 60 WEDGE GATE

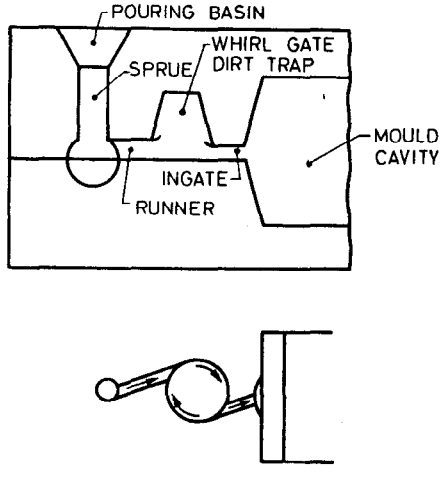


FIG. 61 WHIRL GATE

Green Permeability — The ability of a moulded body of sand in a tempered condition to permit passage of gases through its mass.

Green Sand — Moulding sand containing free moisture, as distinct from sand which has been dried.

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

Green — A mould composed of prepared moulding sand in the moist, undried condition.

Green Sand Moulding — Moulding process involving a clay bonded (8 to 12 percent) moulding sand which is hardened solely through the ramming pressure applied (2.5 to 3 daN/cm^2) prior to stripping.

Green Strength — Compressive, shear, tensile or transverse strength of a tempered sand mixture at room temperature.

Grey Cast Iron — Cast iron in which the carbon is predominantly present as graphite.

Grinding — Removing gates, fins and other projections from castings by means of an abrasive grinding wheel.

Grinder — Workman who uses a grinding wheel.

Grinding Machine/Grinder — Static machine used for grinding.

Grinding Mill — Sand-processing unit, comprising heavy mill rollers running and bearing on the sand layer.

Grinding Wheel — Abrasive materials such as silicon carbide, aluminium oxide, corundum, emery, bonded with clay, rubber, synthetic resin, etc, and formed under pressure into wheels. The wheels are vitrified or baked depending upon the type of bond.

Grit/Shot — In the foundry industry any metal substance divided into small particles.

Guide Pin/Leader Pin — Dowel pin, whereby the two halves of a mould register. As a rule, there is such a pin at the corners of the fixed die (*see* 5 of Fig. 4).

Guide Pin Bushing — Bushing into which the related guide pin is inserted. As a rule, there is a guide pin bushing at each corner of the moving die half.

Guide Track — Device for guiding a movable part, generally with a non-rectilinear profile.

Gumming of Cores — Assembling various cores by means of an adhesive.

Gypsum — A common mineral, mostly hydrated calcium sulphate, used in investment moulding plaster casting and in pattern making.

H

Half-Core Box — Simplified box whereby the two identical halves of a core to be cemented will make up the core assembly.

Hammer Mill — Equipment using the centrifugal force of mechanically-driven hammers to mill and break up chunks of sand when reclaiming sands other than green sand (Fig. 62).

Hand Moulding — Moulding operation wholly carried out by hand or hand tools.

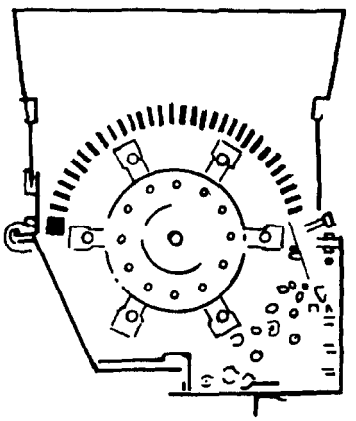


FIG. 62 HAMMER MILL

Hand Moulding Machine — Hand moulding machine in which ramming takes place by hand through some mechanical device.

Hand Ramming — Ramming the sand by means of a hand tool.

Hand Shank — Tool for handling small ladles and crucibles.

Hand Shank Ladle — Pouring ladle of sufficiently small capacity to be handled by one or two men.

Hardness, Sand — Resistance offered by the surface of a sand mixture to small area deformation. A distinction is made between green and dry hardness.

Hard Spots — Dense inclusions in a casting, that is, oxides, iron particles, sand, etc, which are harder than the surrounding metal and cause machining difficulties.

Heart and Square — *See* under 'Moulding tools and equipment'.

Hearth — In a furnace, the portion that holds the molten-metal or bath.

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

Heat Insulating Sleeve — Sleeve or insulating material the inner portion of which conforms to the cylindrical portion of a feeder head.

Heat Resisting Cast Iron — Cast iron which can be used at high temperatures without becoming oxidized or deformed to a degree incompatible with its use.

Heavily Tapered Solid Core Box — Core box without removable apart and with tapered sides to permit core removal by turning over.

Heel — Metal left in ladle after pouring has been completed; metal kept in induction furnaces during stand-by periods.

Hexamethylenetetramine — A heterocyclic compound $(CH_2)_6N_4$, highly soluble in water. Heat decomposes it into formaldehyde and ammonia, whence its addition to the phenolic resins used in shell moulding.

High-Alumina Cement — Silicate cement first made in France by fusing slags high in alumina in an electric furnace.

High Duty Cast Iron — Cast iron with good mechanical characteristics, for example tensile strength of 300 MPa (30 daN/mm^2).

High-Pressure Moulding — Similar to machine moulding using green sand performed at a squeeze pressure from 10 to 20 daN/cm^2.

Hindered Contraction — Exaggeration of some dimensions of the casting due to abnormally high resistance of the mould, cores or rammers to contraction of the casting during solidification and cooling.

Hinge Pin — The pin of a rotary joint which allows rotation about an axis.

Holding Furnace — A furnace for holding molten-metal, from other melting furnaces, at the proper casting temperature.

Holding Investment — An investment adhering to the precoat investment, but of coarser particle size and filling in the space between the stacked patterns and the cylinder in block moulds.

Hollow Pin — Short pin fastened on the drag box; receives the bush of the cope box to keep it in place after the mould is closed. The tail of the closing pin is introduced in the hollow pin bore (*a*) (Fig. 63).

Hopper — Temporary storage device, emptying through the base and to do this, often tapered on the underside.

Horn Gate — Re-entrant gate the longitudinal axis of which is half-round, occasionally used for bottom pouring and, as its name implies, shaped much like the half-volute of a hunting horn (*a*) (Fig. 64).

Hot Blast — Blast which has been heated prior to entering into the combustion reaction of a cupola.

Hot Blast Cupola — Cupola, the blast of which is heated by the spent gases or by a separate generator.

Hot-Box — A process involving a thermosetting bonded-sand usually accelerated by a catalyst. Packing is usually performed by blowing. The hardening time,

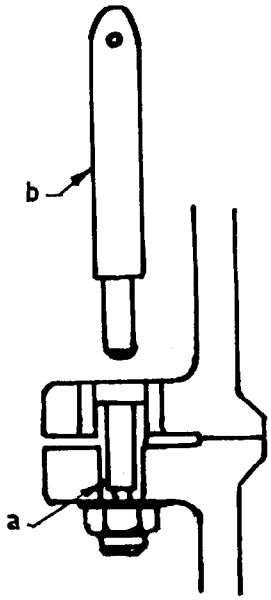


FIG. 63 HOLLOW PIN

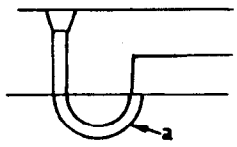


FIG. 64 HORN GATE

while in contact with the box heated to 180-200°C, ranges from 15 to 20 s. Stripping takes place once the thickness of hardened sand suffices.

Hot Chamber Machine — A die casting machine in which the metal chamber is immersed in the molten-metal in a built-in furnace. The chamber itself is called a gooseneck from its appearance, and the machine is sometimes referred to as a gooseneck machine.

Hot Cracking — A crack often scarcely visible because the casting in general has not separated into fragments. The fracture surfaces may be coloured because of oxidation. The design of the casting is such that the crack would not be expected to result from constraints during cooling. It may result from rough handling of the casting while hot or excessive temperature at shake out.

Hot Deformation — The change in shape which occurs when a sand specimen initially softens due to the action of heat, and later changes in shape either under pressure or sags due to its own weight.

Hot Metal — Metal hot enough to fill the mould correctly and allow successful casting.

Hot Sand — Moulding sand at more than 10°C above room temperature.

Hot Spots — Localized areas of a mould or casting where high temperatures are reached and maintained for a period of time.

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

Hot Tear — More or less deep intercrystalline fissure of irregular outline. The crack often shows a fine dendritic structure with an oxidized surface. The defect most often appears in the last sections of the casting to solidify in which constraints are present (section changes and re-entrant angles for example).

Hydrogen Embrittlement — Loss in ductility in metals resulting from the absorption of hydrogen.

I

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

Impregnated Coke — Desulphurizing and deoxidizing agent chiefly used for making spheroidal iron.

Impregnation — The treatment of castings with a sealing medium to stop pressure leaks.

Imprint (the Pattern in the Sand) — To produce an imprint or a part of an imprint, by causing penetration by pressure of the flattener or part of the core box in the sand, and not by ramming the sand around the pattern or part of the core box.

Inclusion — Particle of composition different from this of the casting, located in the casting or at its surface and formed of slag, sand, blacking, oxides, silicates of sulphides.

Index of Basicity — Ratio of the content by weight of basic oxides to that of acidic oxides contained in a slag or refractory. The following are always considered:

a) as basic oxides, lime (CaO) and magnesia (MgO),
b) as acidic oxides, silica (SiO_2) and according to some literature data, alumina (Al_2O_3) and phosphoric anhydride (P_2O_5). A substance is assumed to be basic when its basicity value is greater than 1 and acidic when less than 1.

Indicator — An instrument that displays any physical or electrical quantity.

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

Ingot Mould — A mould in which ingots are cast.

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

Inoculation — Addition to molten-metals of substances called 'innoculant' intended to create nuclear for crystallization of selected constituents, for instance graphitic eutectic.

Insert — Part formed from another material, usually a metal, placed in the mould and appearing as integral structural part of the final casting.

Insert Core — Intricate cores are sometimes produced with an insert core, made and baked separately, rammed up with the main core and baked with it. In other cases, the main core is made into two parts and the insert core pasted to one part and baked with the assembled core; or the insert core and two-part main core can be made separately and pasted together after baking.

Inspection — Testing a material, a part, a batch or a machine in order to ascertain if it conforms to the required qualities stipulated in a contract or a specification or admitted by usual practice.

Intake Port/Metal Inlet — Machined port opening on the shot sleeve or liner of same. As it is at the level of the molten-metal, the metal can be poured in by gravity when the shot plunger has come back to the home position.

Intensifier — Hydraulic device that increases the pressure against the metal as the shot ends.

Internal Chill — Metal chills provided inside the moulds for faster solidification of the metal to avoid shrinkage and other defects (thus, different from 'inverse chill').

Internal Stress/Residual Stress — Stress occurring between different parts of a casting as a result of non-uniform plastic deformation or unequal cooling rate after casting or heat treatment.

Internal Shrinkage — A void or net work of voids within a casting caused by improper feeding of that section during solidification.

Interrupted Quenching — Partial hardening from above the transformation range by quenching in a medium for a specified time, followed by cooling in air. Sometimes known as interrupted quenching.

Inverse Chill — The edges surrounding the fractured surface show a normal grey iron structure whereas the interior sections may be entirely white without transition, show only white areas or may be largely mottled.

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

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

Inversion Casting — A single mould is directly attached to the electric furnace in which the metal is melted in a reducing atmosphere so that no slag is formed.On inverting the furnace the metal runs into the mould.There are no heavy feeders and oxidation is prevented.

Investment Casting — Term applied to a moulding technique making use of destructible patterns coated with a refractory doing duty as a jointless mould.

Investment Precoat — An investment, adhering to the precoat investment, but of coarser particle size and filling in the space between the stacked patterns and the cylinder in block moulds.

Iron, Hard (Iron, White) — Iron possessing white fracture because carbon is fully or substantially in the combined state.

Iron, Malleable — A cast iron-carbon alloy which solidifies in the as cast condition in a graphite-free structure, the total carbon being present in the combined form as cementite, and is converted structurally by heat-treatment into a matrix of ferrite containing nodules of temper carbon.

Iron Carbide — Combination of carbon and iron in defined proportion. There are several iron carbides of which the most common is cementite (Fe_3C).

J

Jack — Appliance used for raising a load, and either hydraulically or mechanically actuated.

Jack Stars — Multipointed white iron or hard iron bodies used in a tumbling barrel to assist in cleaning and polishing.

Joint Flash/Joint Fins — Flat projection often with lacy edges perpendicular to one of the faces of the

casting. It can occur wherever two elements of the mould intersect.

Joint Line — Line which is theoretical or traced on a pattern. It defines the areas which belong to two different parts of the mould.

Joint Sealing (1) — Slight ridge of sand made with spatula on the joint surface, right round the imprint, the purpose of this is to avoid escape of metal during casting in a green sand mould.

Joint Sealing (2) — Relief raised or added around the imprint, on the joint of a mould to prevent any escape of metal.

Jolt Moulding Machine — A machine in which the jolting action is used to achieve the compaction of sand in the mould.

K

Kaolin — Clay the main mineral of which is kaolinite.

Kaolinite — Kind of clay with thin laminations. Slightly expandable, it does not exchange bases very readily.One of the principal constituents of refractory and moulding-sand clays.

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

Kish Tracks — Thin, shiny films of graphite, generally folded and wrinkled in shape, found within a wall of the casting where they cause a discontinuity in the casting.

Knock-Out Bar — Steel bar inserted in the pattern and used for knocking out.

Kyanite — A silicate of aluminium ($Al_2O_3.SiO_2$) which alters to mulldite and free silica at 1 100-1 410°C, accompanied by considerable expansion.

L

Ladle — Metal receptacle normally lined with refractories used for transporting and pouring molten-metal.Types include hand, bull, crane, bottom-pour, holding, teapot, trolley, shank, lip-pour, buggy, truck, mixing reservoir, etc.

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

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

Ladle Casting — A crucible or iron vessel lined with refractory material for conveying molten-metal from the furnace and pouring it into the mould.

Ladle, Liner — A preformed shape made of the same materials as graphite crucibles and widely used in steel ladles in non-ferrous foundries for carrying metal from the melting unit to flasks.

Ladle Lip — That portion of a ladle over which the metal is poured.

Ladle, Receiving — A ladle placed in front of the cupola into which all metal is tapped. It acts as a mixer and reservoir and to smoothen out the metal flow.

Ladle, Sludge — A hemispherical steel ladle used to remove sludge from the bottom of melting pot.

Ladle, Teapot — A ladle in which metal is removed from the bottom rather than from the top of the ladle.

Lashing of a Core — Fastening a core into its print with a metallic attachment connecting it to a cross-member of a moulding box.

Launder — *See* 'Cupola runner trough'.

Lead Quench — Quenching of hot metal in molten lead to gain quenched and tempered properties in one step and thus avoid martensitic conditions.

Levitation Melting — Heating, melting and suspending metals in space with an electromagnetic field.

Lifting Beam — Beam either hinged at both ends that may be inserted into the axial trunnions of a small moulding box, or fitted with pulleys for endless chains or slings that may be inserted into the lifting handles or lifting eyes of the heavier moulding boxes.

Lifting Pin — Vertical metal rod acting on the stripping plate or the box to execute the stripping operation by raising the box in certain machines.

Lifting Plate — A small iron plate with a hole through which a threshed bolt is attached to facilitate removing the pattern from the mould.

Limestone — A sedimentary rock composed essentially of calcium carbonate, the principle fluidizer for cupola and blast furnace melting. Efficient fluxing requires that the stone contain not less than 95 percent calcium carbonate.

Linseed Oil — The most common of all drying oils, used principally as a base for core oil.

Lip Runner — *See* 'Connor block runner'.

Liquidus — A line on a binary phase diagram or a surface on a ternary phase diagram, representing the temperatures at which freezing begins during cooling, or melting ends during heating, under equilibrium conditions.

Load-Extension Diagram/Stress-Strain Diagram — A diagram showing the relationship between applied stress (or load) and resulting elongation, in the tensile test.

Loam — Naturally clay-bonded sand, comparatively finely-grained with a high content (over 25 percent) of clay, namely used in the conventional strickling technique.

Loam Core — Core made with loam and by loam moulding processes.

Loam Moulding — Process similar to dry-sand moulding whereby cohesion after hardening is improved by increasing the clay-binder content.

Loose Pattern — Pattern executed in two or more parts which can be separated to facilitate moulding and stripping.

Loss on Ignition — The loss in weight which results from heating a sample of material to a high temperature after preliminary drying at a temperature just above the boiling point of water. The loss in weight upon drying is called free moisture; that which occurs above 105°C is loss on ignition.

Lost Wax Process — A casting process in which a wax or thermoplastic pattern is used. The pattern is invested in a refractory slurry, after the mould is dry, the pattern is melted or burnt out of the mould cavity (*see also* 'Investment casting').

Low-Pressure Die Casting — In this process, the air pressure (0.6 to 1.5 bar) takes effect over the surface of the molten-metal the temperature of which is held in a leakproof crucible, and causes the said metal to rise through a tube dipped in the latter and connected to the die bottom through which gating takes place.

Lug — A projection of variable form on a casting.

Lute (1) — A mixture of fire clay used to seal cracks between crucible and cover or between container and cover when heat is to be applied.

Lute (2) — To seal with clay or other plastic material.

M

Machinability — Ability of a solid to be shaped with stock removal using a cutting tool, the object being parts accurately machined to the macro-geometrical and micro-geometrical dimensions in the limits of preimposed tolerances and at acceptable cost.

Machine Moulding — Moulding operation either wholly or partly carried out with a machine.

Machining Allowance — Surplus material left on a casting, to be removed by one or more subsequent machining operations to obtain the final desired dimensions.

Macrostructure — The structure of a metal or alloy visible to the naked eye or when slightly magnified, subsequently to an adequate preparation.

Magnesite — A mineral composed of magnesium carbonate used as a refractory. Upon calcination, magnesite loses most of its CO_2, converting to magnesia, which is highly refractory.

Magnesite-Chrome Brick — Refractory brick, substantially of a mixture of deadburned magnesite, and refractory chromite.

Magnetic Crack Detection/ Magnetic Particles Inspection — A method of non-destructive testing for locating surface and subsurface discontinuities in ferromagnetic material.

The material or part is magnetized, discontinuties which lie in a direction generally transverse to the direction of the magnetic field will cause a leakage field to be formed at and above the surface of the part. The presence of this leakage field, and therefore the presence of the discontinuity is detected by the use of ferromagnetic particles applied over the surface, some of these particles being attracted by the leakage field; the particles form an outline of the discontinuity and indicates its location, size, shape and extent.

Magnetic Separator — A device used to separate magnetic materials from used sands. The crushed material is separated while travelling on a conveyor belt past a magnet.

Main Runner — Runner collecting the whole filling flow before dispatching it towards a multi-cavity mould.

Making the Pattern of a Casting — Building up the pattern of a casting from the master core. This consists by providing the said core with the subsidiary elements needed.

Malleable Cast Iron/Malleable Iron — Cast iron whose increased deformational capacity is derived through subjecting a white cast iron to a malleabilizing treatment by either graphitization or decarburization, thereby altering its structure or composition.

Malleable Pig Iron — Pig iron of composition suitable for production of white cast iron for malleabilizing.

Malleabilizing Anneal — Process of annealing white cast iron in such a way the combined carbon is removed completely (decarburization), or wholly or partly transformed into graphite (graphitization). This process is used for making malleable iron castings.

Malleabilizing by Decarburization — A process in which white cast iron is made malleable by annealing in an oxidizing medium so that substantial decarburization occurs and the remaining carbon is precipitated in the form of graphite nodules.

Malleabilizing by Graphitization — A process in which white cast iron is transformed into blackheart malleable by annealing in an inert medium without decarburization so that the carbide is decomposed to ferrite or pearlite and temper carbon in the nodular form.

Martensitic Cast Iron — Cast iron with matrix constituted of martensite.

Master Alloy — Alloy specially prepared in order to facilitate the introduction of one or more elements into a foundry alloy.

Master Core — Master pattern to exact dimensions of the core required for:

- — moulding a master template of a core box cast using unshrinking materials;
- — providing it with padding and accessories in order to have a master pattern of the casting.

Master Pattern — Model to be duplicated with utmost dimensional precision.

Master-Plate Frame — A copying stand.

Master Template — Form-control template to be duplicated by a copy milling machine.

Match Plate — A plate of metal or other material integrally cast with the cope portion of the pattern on one side and the drag portion on the other side of it.

Matrix — The principal constituent of an alloy, exhibiting some continuity the other constituents being embedded therein.

Medium Phosphorus Iron — Pig iron containing from 0.5 to 1.0 percent phosphorus.

Melting/Melt Down — Passage from the solid to the molten state through the effect of heat.

Melting Range — The range of temperature in which an alloy melts; that is, the range between solidus and liquidus temperature.

Melting Rate — The tonnage of metal melted per time unit.

Melting Ratio — The ratio of the weight of fuel used for melting to the weight of metal charged into the furnace.

Melting Temperature/Solidification Temperature — Temperature at which the change of solid to liquid (fusion) or of liquid to solid (solidification) takes place. This temperature depends on the pressure and only well defined for pure metals, or eutectics of definite combinations. It is the temperature at which solid and liquid are in equilibrium at the corresponding pressure.

Melting Zone (of Cupola) — The portion of cupola in which the metal melts.

Mesh (of a Sieve) — Figure formed by two successive weft and warp wires.

Mesh Opening — Free space between two consecutive threads of a mesh.

Mesh Size (of a Sieve) — Usually denoted by the number of mesh openings per unit of length. Such size, since it depends on wire diameter between the mesh, is not consistent with the mesh opening.

Metal — An opaque lustrous elemental substance. It conducts electricity and can be heated to a melting point and will form positive ions in solution. As temperature increases conductivity decreases.

Metallurgical Coke — *See* 'Furnace coke'.

Metastable — Marked by only a slight margin of stability.

Metallostatic Pressure — Hydrostatic pressure against the walls of a cavity filled with molten-metal.

Microhardness — Hardness measured under light loads, say from 5 to 50 g or 200 to 2 000 g, so as to involve only specific elements of the material investigated the measurement is carried out with a microhardness tester.

Micron/Torr — Pressure unit in common use equal to the conventional millimetre of mercury.

1 torr = 133.3 Pa (approx.)

In addition to the millibar and torr and their submultiples the term 'micron' meaning micrometer of mercury is still common in the field of vacuum technology.

Microshrinkage/Porosity/Leakers — Spongy area or small cavities generally situated in the last sections to freeze: heavy walls, inter-sections, re-entrant angles, cores or adjacent to gates and risers impairing the casting's tightness.

Microstructure — The structure of a metal or alloy on a minute scale as revealed by the microscope subsequently to a suitable preparation.

Mill Scale — Iron oxide scale formed on steel during hot working process.

Milled Blast Shot — Round shot ground in a ball or a hammer mill and then graded by sieving.

Mischmetal — An alloy of rare earth metals

containing about 50 percent cerium and for the remaining lanthanum, neodynium and similar elements.

Miscibility — Ability of two or more liquids to form a homogeneous solution.

Mismatch/Cross-Joint — Cope and drag have not been correctly assembled; it looks as if the cope would have been translated with relation to the drag: the casting seems to have been subjected to a shearing action parallel to the parting line. There can be pattern variation, a mould variation, a core shift.

Misrun — Casting not fully formed resulting from metal poured so cold that it solidifies before filling the mould completely.

Mixer — Sand processing unit consisting essentially of a shaft fitted with plows or paddle wheels which revolve in a tub or a vat.

Moisture — Water which can be driven off by heating to about 105° to 110°C.

Moulding Sand — A sand, containing all the substances required (bonding agents, additives) and having been subjected to some process (frictional, mixing, separative, etc) so as to make it ready for mould making.

Monolithic Lining — A lining made without the customary layers and joints of a brick wall. Usually made by tamping or casting a refractory material.

Monolithic Lining Material/Ramming Mix — Material constituted of refractory grains of dimensions appropriate to its use, and a suitable binder. It is used for the preparation of monolithic linings.

Montmorillonite — Kind of clay with laminations no thicker than 10 angstroms. Highly expandable, it exchanges bases very readily. One of the principal constituents of bentonite.

Mottled Cast Iron — Cast iron in which the carbon is partially present as iron-carbide and partially free as graphite.

Mould Blower — A shell moulding instrument for blowing sand mixture on to the pattern with compressed air; allows for faster production than gravity roll over dump.

Mould Joint — The matching surface between the cope and the drag of a mould.

Mould Weight — General term denoting the metal weight placed on the mould to prevent it rising.

Mouldability — Ability of a sand to flow into a flask and around a pattern, measured by the amount of sand falling through an inclined screen or slot.

Mouldability Controller — Device for controlling water additions to sand mixes to maintain a consistent mouldability index.

Moulding — The procedure for making refractory moulds capable of conforming to and retaining the shape of patterns and core boxes.

Moulding Allowance — Allowance provided for on the pattern to compensate for dimensional differences due either to deformations of the mould or the core, or to contraction anomalies.

Mould — The form, made of sand or any other investment material, which contains the cavity into which molten-metal is poured to produce a casting of definite shape and outline.

Mould, Book — A split mould made in a flask that is hinged at the side.

Mould Cavity — In a mould, the hole/depression in which, when filled with metal becomes the casting.

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

Moulding Bench — Making sand moulds from loose or production patterns at a bench not equipped with air or hydraulic action.

Moulding Board — The board upon which the pattern is placed to make the mould.

Moulding, Floor — Making sand moulds from loose or production patterns on floor.

Moulding Gravel — The coarser and more permeable grades of moulding sand and generally used in producing castings of exceptional size and weight (*see also* 'Chamotte').

Moulding, Hand — Making sand moulds by hand.

Moulding Machine — Machines required for preparing the moulds.

Moulding Material — A material that is suitable for making moulds.

Moulding, Pit — Moulding method in which the drag is made in a pit in the floor.

Moulding Sand Mixture — A sand mixture that is suitable for making moulds.

Moulding, Stack — A moulding method which make use of both, sides of one-half mould, one side acting as the drag and the other half as the cope, all the castings being poured through a common downgate.

Mould, Invested — Mould containing the expandable pattern and investment upon completion of investing.

Mould, Semi-Permanent — A permanent mould in which sand cores are used.

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

Mulling — Process of mixing sand and clay particles by compressing with a heavy roller in preparation for moulding. Also, the process of mixing sand with a rubbing action as well as stirring.

Mull Sand — To cause the grains of a sand to slide together in order to coat them as uniformly as possible with a binder.

Multiple Cavity Mould/Multiple Cavity Die — Mould with several identical or different cavities.

Multiple Core Box — Core box containing several core impressions.

Multiple Coreprint — Print corresponding to several deliveries of one or more cores.

N

Natural Ageing/Seasoning/Weathering — Spontaneous change, as a function of time, at ambient temperature and without the intervention of any other factor, of structure and properties of a metal.

Natural Draught — Draught brought about solely by the difference in temperature, hence, the density and the pressure of the inner and outer atmospheres.

Natural Gas — Gaseous fuel issuing from the earth's crust, a mixture of saturated hydrocarbon, principally methane. Its net calorific value ranges from 7 500 to 9 000 kcal/m^3.

Natural Moulding Sand — Silica sand originating from deposits and containing clay in suitable amount (8 to 20 percent), which makes it straight usable for moulding.

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

Naturally Clay-Bonded Sand — Quartz sand the fractional size distribution of which, lower than 20 microns, exceeds 4 percent, largely consisting of clay.

Neutral Refractory — A refractory material which is neither definitely acid nor definitely basic. The term is relative in most cases, since at high temperature such a material will usually react chemically with a strong base functioning as a weak acid, or with a strong acid functioning as a weak base. Chrome refractories are the most nearly neutral of all commonly used refractory materials.

New Sand — Moulding sand which has neither been in contact with liquid metal nor mixed with a sand having come into this contact.

No Bake Binder — *See* 'Cold setting binder'.

Nodular — Appearing in the form of nodules, or containing nodules.

Nodular Cast Iron (Spheroidal Graphitic Cast Iron) — Iron of a normally grey cast iron type that has been suitably treated with a nodularizing agent, such as magnesium or cerium, so that all or the major proportion of its graphitic carbon has a nodular or spheroidal form as-cast.

Nodular Graphite — Graphite or carbon in a nodular form.

Normal Segregation — Concentration of alloying constituents that have low melting points, in those portions of a casting that solidify last.

Normalizing — A process in which steel casting is heated to a suitable temperature above the transformation range and is subsequently cooled in air to room temperature.

O

Oddside — A cope rammed up with a flat joint to take the place of a turnover board, or rammed with dry sand, the parting joint made and stoved to act as a semi-permanent means of forming the joint on the drag, which is rammed up on it.

Off-Grade Metal — Metal whose composition does not conform to specification.

Oil, Core (Mould, Oil) — Oil used as a binder in making core or mould.

Oil Sand — Sand bonded with drying oils as linseed oil.

Oil Sand Core — A core in which the sand is bonded by an oil binder.

Olivine — A naturally occurring mineral composed of fosterite and fayalite, crushed and used as a moulding sand.

One-Piece Pattern — Solid pattern, not necessarily made from one piece of material. May have one or more loose pieces.

Open Coreprint — Print open to air (*a*) (Fig. 65).

Open-Flame Furnace — In comparison with the crucible furnace, the metal charge in the open-flame type of furnace is confined in the refractory lining, with the flame and products of combustion coming in direct contact with the metal.

Open-Grain Structure — A defect wherein a casting,

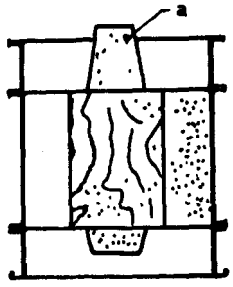


FIG. 65 OPEN COREPRINT

when machined or fractured, appears to be coarse grained and porous.

Open-Hearth Furnace — A furnace for melting metal, wherein the bath is heated by the combustion of hot gases over the surface of the metal and by radiation from the roof.

Open-Sand Casting — A casting which is produced without top flask.

Optical Pyrometer — An electrothermal instrument remotely indicating the temperature of the controllable imaged brightness of the heat source by comparison with that of a standard brightness source.

Optimum Moisture — That moisture content which results in the maximum development of any property of a sand mixture.

Orange Peel — Casting's surface covered with hollow blemishes resembling smallpox. The blemishes are larger on thick castings or heavy sections.

Orange Peel Bucket — A drop bottom bucket used for charging cupolas; the drop bottom is divided into a number of sections that appear to peel back as the bucket opens.

Oven, Drying — An oven for drying moulds or cores.

Overageing — Ageing a non-ferrous, precipitation-hardening alloy under conditions of time and temperature greater than those required to obtain maximum strength or hardness.

Overhang — The extension of the end surface of the cope half of a coreprint beyond that of the drag in order to provide clearance for closing the mould.

P

Packing (Packing Material) — Sand, gravel, mill scale, or similar material used to support castings packed in annealing pots to prevent possible warpage under high temperature.

Padding — The application of extra metal to the casting by increasing the taper in the direction of the feeder heads so as to encourage good directional solidification and hence uniformly dense and sound castings.

Parkerizing — Process used to produce on steel a protective coating of ferric phosphate by immersion in a bath containing free phosphoric acid together with manganese dihydrogen phosphate.

Parted Pattern/Split Pattern — Removable pattern, generally following the mould joint, to facilitate moulding.

Partial Miscibility — Miscibility limited to certain proportions.

Parting Compound — A material dusted or sprayed on patterns or mould halves to prevent adherence of sand and to promote easy separation of cope and drag parting surfaces when cope is lifted from drag.

Parting Gate — Gate at the mould joint.

Parting Line — A line on a pattern or casting corresponding to the separation between the cope and drag portions of a mould.

Pattern-Making — Making of the pattern, core boxes and, in a wider sense, all items needed for the manufacture of castings.

Parting Plane — It is the plane separating the cope and drag.

Pattern Plate — Follow board, or surface plate representing the surface of the joint, which are permanently secured to the pattern proper, the gates, feeding systems, sighting marks and any other ancillary needed.

Parting Sand — Fine sand for dusting on sand mould surfaces that are to be separated.

Pattern Shop — The pattern-making shop.

Patching — Repair of a furnace, mould or core.

Pattern — A form of wood, metal or other material around which moulding material is placed to make a mould.

Pattern Assembly — A combination of patterns attached directly or indirectly to a sprue pattern, and which will be invested simultaneously.

Pattern Board — Board having a true surface upon which a pattern is placed preparatory to making a mould of pattern.

Patternmaker — A craftsman engaged in production of foundry patterns.

Pattern Coating — Materials applied to wooden patterns to protect them against moisture and abrasion of moulding sand.

Pattern Die — A body composed of two or more mating parts, containing one or more negative impressions of the master pattern and used for production of expandable patterns.

Pattern Draft (Delivery Draft, Draw Taper) — Taper allowed on vertical faces of a pattern to permit easy withdrawal of pattern from the mould.

Pattern, Grand Master — Pattern constructed with triple shrinkage allowance from which metal master patterns are made.

Pattern Injection — The process of filling the pattern die with expandable material, usually in the liquid or plastic state.

Pattern Layout — Full-sized drawing of a pattern showing its arrangement and structural features.

Pattern Material Expandable — A material to be formed in the pattern die, invested in a mould and completely removed from the mould by melting, vaporization, combustion, or solution. Examples are waxes, frozen mercury, low melting alloys, etc.

Pearlitic Cast Iron — Cast iron with matrix constituted of pearlite.

Pearlitic Malleable Iron — Product of malleabilization of cast iron in which the matrix consists essentially of pearlite or some other transformation product of austenite with much of the carbon present as temper carbon.

Peeling — Free removal of moulding sand from casting upon shaking out from the mould.

Periclase — Natural magnesia in nodular form.

Permanent Mould — A metal mould of two or more parts that is used repeatedly for the production of many castings of the same form.

Permeability — The property of sand which permits passage of gases.

Permeability, Baked — The property of a moulded mass of sand which when baked at a temperature above 110°C and then cooled to room temperature, permits the passage of gases through it.

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

***p*H** — The negative decimal logarithm of the effective hydrogen ion concentration or activity in gram equivalents per litre. It is used in expressing both acidity and alkalinity on a scale of 0 to 14 on which 7 represents pure water or neutrality, values less than 7 represent acidity, increasing from 7 to 1 and values greater than 7 up to 14 represent increasing alkalinity.

***p*H-Meter** — Battery with a hydrogen, quinhydrone or antimony electrode the e.m.f. of which indicates approximately the *p*H of an electrolyte. Colour indicators are also used.

Phase — A constituent completely homogeneous both physically and chemically separated of the rest of the alloy by definite bounding surfaces.

Phenolic Resin — A resin made by the polymerization of a phenol with an aldehyde, used as a binder for cores and sand moulds.

Physical Metallurgy — The science concerned with the physical and mechanical characteristics of metals and alloys.

Pickling — Removal of oxides or other compounds of the basis metal by chemical or electrochemical action.

Pig — An ingot of virgin or secondary metal to be remelted for use.

Pig Bed — Small excavations or regularly made open-sand moulds on the foundry floor to hold the excess metal of a heat. May also denote a group of metal pig moulds.

Pig Iron — The primary product of smelting iron ore containing usually about 3.0 to 4.5 percent carbon along with silicon, manganese, phosphorus and sulphur in varying amounts, depending on the quality of raw materials used. Pig iron is used in the foundry or for conversion into steel.

Pig Iron, Basic — A special grade of pig iron made for the basic process of steelmaking.

Pig Iron, Charcoal — A pig iron produced in the blast furnace with charcoal as fuel; generally a low phosphorus iron and is considered to be of higher carbon content and greater purity than coke iron.

Pig Iron, Chill-Cast — Pig iron cast into metal moulds or chills; if a machine is used the product is known as 'machine-cast pig'.

Pig Iron, Refined (Pig Iron Synthetic) — Pig iron produced by smelting steel scraps and coke in electric furnaces. This process is generally used when special quality pig iron with very, low phosphorus content is desired.

Pig Machine — A machine having an endless belt of metal moulds for casting pigs of iron and other metals.

Pilot Casting — Experimental casting made from a production pattern to check the accuracy of dimensions and quality of castings which will be produced from the pattern.

Pin-Hole Porosity — Minute holes scattered

throughout the surface of a casting resulting from microshrinkage or gas evolution during solidification.

Pipe — A cavity formed by contraction of metal during solidification and occurs where the last portion of liquid metal freezes as in the case or riser.

Pit — A sharp depression in the surface of metal.

Plasma Arc Furnace — Furnace which uses an electric arc to ionize a gas causing a flow in an electrical field of such high velocity that temperatures of 3 315 to 5 537°C are developed.

Plaster Moulding — Moulding using pure plaster or plaster containing a sand filler.

Plastic Clay — A clay with sufficient natural stickiness to bond together or to bond with others, materials which have little or no bond properties.

Plate Mould — To make a mould or part of a mould using a pattern plate.

Platens — Flat elements of a pressure casting machine on which the two mould die blocks are fixed.

Plunger Speed — Speed at which the injection piston moves during the filling of the mould cavity in die casting.

Pneumatic Rammer — A rammer whose rod is powered to and fro by compressed air in a light weight cylinder provided with handles.

Porosity (Metal) — Unsoundness in cast metal due to blowholes and shrinkage cavities. Also, the voids resulting from tearing off of coarse graphite flakes which machining of soft cast iron.

Porosity (Sand) — The ratio of volume of the pores or voids to volume of the entire mass, usually expressed as a percentage. Generally the volume of the pores is obtained by determining the amount of water or gas absorbed by the mass, and therefore does not include the volume of the sealed pores. The result so obtained is a apparent porosity and not true porosity. It is not synonymous with permeability.

Pot — A refractory vessel for holding molten-metal. The name is also applied to the metal container in which castings are packed during malleablizing.

Poured Short — Casting which lacks completeness due to the mould not being filled.

Pouring — Filling of moulds with molten-metal from ladle.

Pouring Basin — The enlarged mouth of sprue into which molten-metal is first poured; by proper design of pouring basin air entrapment is eliminated and dross and slag are allowed to float, thus enabling clean metal to enter mould (*see* Fig. 66).

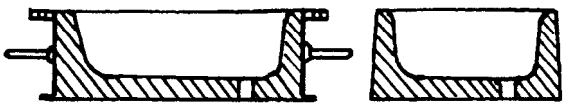


FIG. 66 POURING BASIN

Pouring Cup — The enlarged mouth of the sprue into which the molten-metal is first poured before entering the downsprue (*a*) (Fig. 67).

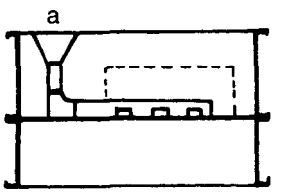


FIG. 67 POURING CUP

Pouring Ladle — Ladle used for filling moulds.

Pouring Nozzle — Refractory nozzle at the bottom of the pouring basin forming the seat of the stopper plug (*d* of Fig. 68).

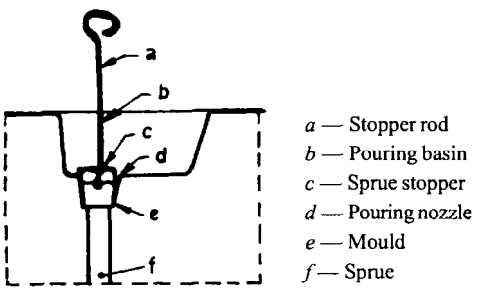


FIG. 68 POURING NOZZLE

Pouring Temperature — Temperature of the metal as it is poured into the mould.

Precipitation — Development of a new phase along specific lattice planes of a supersaturated solid solution.

Precipitation Anneal — A thermal treatment leading to the precipitation of one or several constituents in a supersaturated solid solution.

Preformed Ceramic Core — A refractory aggregate formed in advance and inserted in a wax or plastic pattern to shape the interior of that part of a casting which cannot be shaped by the pattern.

Pressure Feeder/Pressure Riser — Blind feeder head within which the gas pressure is higher than the atmospheric pressure.

Pressure-Tight — A term that describes a casting that is free from such kind of porosity that permits leaking.

Production Foundry — A foundry engaged in manufacture of casting in large quantities, usually highly mechanized to minimize manual labour. May be either a jobbing or captive foundry.

Pricker — A protection on arbour or plate to hold sand.

Print Back — After drawing the pattern, the surface of the mould is dusted with a carbonaceous material such as graphite, coal, etc, and the pattern is replaced, rapped slightly into position, and again removed, leaving a smooth mould surface.

Pull Cracks — Cracks caused in a casting by thermal contraction when two portions become anchored as a result of an irregular shape.

Pull Down — A shrinkage defect. It is a buckle in cope, sometimes severe enough to cause a scab.

Pulverised Coal — Coal reduced to very fine powder form to facilitate its combustion, which is carried out by means of special burners.

Push Up — An indentation in the casting surface due to displacement of sand in the mould.

Pyrometer — An instrument used for measuring elevated temperature.

Pyrometric Cone (Standard Pyrometric Cone) — A pyramid with triangular base, of specific shape and dimension, and of such composition that it bends (the tip bending to the level of the base) at a definite temperature, when it is heated at standardized condition.

Pyrometric Cone Equivalent (PCE) — The number or numbers of the standard cone (or cones) which at temperatures nearest to that at which the test cone bends under standardized condition of the refractoriness test.

Q

Quarry Sand/Pit Iron Sand — Term that usually designates a quarried silica sand or a naturally clay-bonded sand.

Quasi-Flake Graphite — Graphite in form of flakes of irregular shapes and sizes. It appears especially in irons treated for spheroidization but with insufficient magnesium addition.

Quartz — Naturally crystallized silica (SiO_2), stable to 870°C.

Quartzite — *See* 'Gannister'.

Quench Crack — A discontinuity in the form of a crevice which is visible to the naked eye. The crack is clearly delineated by sharp edges and is of uniform width. The walls are coloured due to oxidation by the heat in the case of ferrous alloys.

Quick Ejector Pin — Ejector pin whose motion is speeded up, for example by a cammed system, as ejection ends. Quick ejection pins impart momentum to the stack mould to make it fall down.

Quick Lime — Non-hydrated calcium oxide (CaO).

R

Rabble — A hoe-like tool with long handle used for stirring mixing molten-metal in large furnaces.

Radiant Heat — Heat communicated by radiation and transmitted by electro-magnetic waves.

Radiation Pyrometer — Pyrometer that measures the temperature of the source-emitted radiation. Usually it includes a device with or without a mirror or lens, that conveys radiation into a sensor whose temperature is measured when at balance.

Radiography — Non-destructive method of internal examination in which castings are exposed to a beam of X-ray or gamma radiation. Differences in thickness, density or absorption, caused by internal defects or inclusions, are apparent in the shadow image either on a fluorescent screen or on photographic film placed behind the object.

Raising — Sections of flasks, without bars, used together with flakes to give various depths of flasks desired.

Raised Sand — Massive irregular metallic projections on the drag side of a casting having the appearance of a fracture. The casting shows dispersed sand inclusions especially on the cope surface.

Rake — Tool fitted with claws, used for the removal of incandescent materials after cupola drop.

Ram — Using a ram to squeeze sand locally.

Ramaway — A casting defect resulting from a section of the mould being forced away from the pattern by ramming the sand after it has conformed to the pattern contour.

Rammer — Tool used for ramming either moulding sand or monolithic lining material (Fig. 69 *a* and *b*).

Ramming — The operation of packing sand around pattern in flask to form a mould.

Ramming by Slinging — Ramming obtained by the inertia of a sand to which a sufficient active force has been applied.

Ramming, Jolt (Ramming, Jar) — Packing sand in mould by raising and dropping the pattern and flask

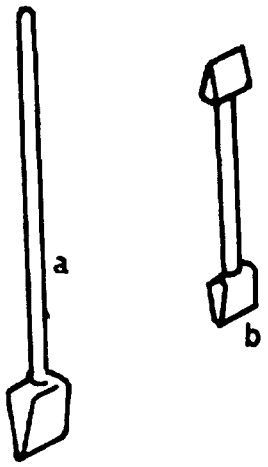


FIG. 69 RAMMER

on a table, the sane itself being the ramming medium. Jolt squeezers, jarring machines, and jolt rammers are moulding machines that use the principle of jolt ramming.

Rapping — Knocking or jarring the pattern to loosen it from the sand in the mould before withdrawing the pattern in sand for drawing.

Rapping Bar — Metal rod used to rap the draw spike to loosen the pattern in sand for drawing.

Rapping Pin — *See* 'Draw spike'.

Rapping Plate — A metal plate attached to pattern to prevent injury to pattern and assist in loosening it from sand.

Rat (Sticker) — A lump on the surface of a casting caused by a portion of mould face sticking to pattern. Sometimes also referred to as sticker.

Rat Tail — A minor buckle, occurring as a small irregular line or lines on a cast surface.

Raw Material — Object material or supply acquired by the company and destined for incorporation into the manufactured product.

Recarburizer — Any carbonaceous material, a high-carbon pig iron, or a high-carbon alloy, added to molten grey iron or steel to increase the carbon content of the metal.

Reclamation — Collection of salvage for re-use.

Reconditioned Sand — Moulding sand, recovered after shake out and then subjected to a process to render it again suitable for moulding.

Recuperator — Equipment for receiving heat from hot, spent gases and using it for preheating of incoming fuel or air.

Red Shortness — Brittleness in metal when it is red hot.

Refined Iron — Pig iron which has undergone a special process to bring the content of certain elements to a previously determined value.

Refractoriness — The ability of a material to withstand high temperature.

Refractory — Heat resisting material usually non-metallic, used for furnace linings.

Refractory Cement — Powder product hardening after mixing with water as a hydraulic binder and possessing refractory qualities after setting.

Refractory Materials, Acid — Ceramic materials of high melting points consisting largely of uncombined silica which reacts with basic materials to form slags.

Refractory Materials, Basic — Bodies largely composed of basic oxides, that is, those which react with acids such as silica, to form salts. Examples are magnesia, alumina and lime.

Refractory Materials, Neutral — A refractory material which is neither definitely acid nor definitely basic. The term is merely relative in most cases, since at high temperature such a material will usually react chemically with a strong base, functioning as a weak acid; or with a strong acid, functioning as a weak base. Chrome refractories are the most nearly neutral of all commonly used refractory materials.

Regenerator — Equipment used for recovering heat from hot, spent gases from a furnace. The regenerator differs from the recuperator in that the hot spent gases are used to heat a brick checkerwork, then, after the flow of the exhaust gases has been turned off, the gases to be preheated are passed through the checkerwork.

Regenerative Furnace — A type of furnace in which air and gaseous fuel are preheated by passing through regenerators or recuperators.

Removable Core — Metal core ejected with the casting and subsequently dissociated from the latter. Removable cores are used in the making of inner undercut shapes, inner threads, and so forth.

Replacing Pattern in the Mould — Operation which consists, after application of a mould blaking, of making it adhere to the mould surface by replacing the pattern in its cavity.

Repress — A machine for pressing stiff or soft clay blanks into brick shapes.

Repressed Brick — Brick formed by cutting a column of clay from auger machine into blanks and later pressing one of these blanks in a mechanical press.

Resin (1) — Amorphous substance, extracted from plants and trees (natural resins).

Resin (2) — Macromolecular substance chemically synthesized and brought about through polymerization or polycondensation of smaller parent molecules.

Resin Binder/Plastic Binder — Thermosetting synthetic resin material, usually phenol formaldehyde, urea formaldehyde or polyurethane, used as bonding agent for core sands.

Resin-Bonded Sand — Resin-bonded moulding or core sand.

Resistance after Setting — Compressive resistance of a mould or core sand after chemical, hydraulic or thermic setting.

Resistance Pyrometer — Pyrometer in which temperature is measured by the change in electrical resistance of a coil, usually of platinum, when the coil is inserted into the furnace.

Rasol — A grade of phenolic resin the formalin/phenol proportion of which is greater than 1. It is derived in an alkaline medium, and likely to harden when heated in presence of an acid catalyst in excess.

Retained Strength — Compressive, shear, tensile or transverse strength attained by a sand mixture after being subjected to a cycle or cycles of heating and cooling which approximate foundry practice.

Rheology — The science of deformation and flow of matter.

Riddle — A screening device, manually or mechanically operated, for removing coarse particles and contamination from moulding sand.

Ringelmann's Scale — In air pollution control, a black and white mesh scale reading from all clear to solid black, used to measure the density of smoke. Observer normally uses chart comparator 15 m from the point where smoke emits.

Riser — A reservoir of molten-metal provided to compensate for the internal contraction of the casting as it solidifies (Fig. 70).

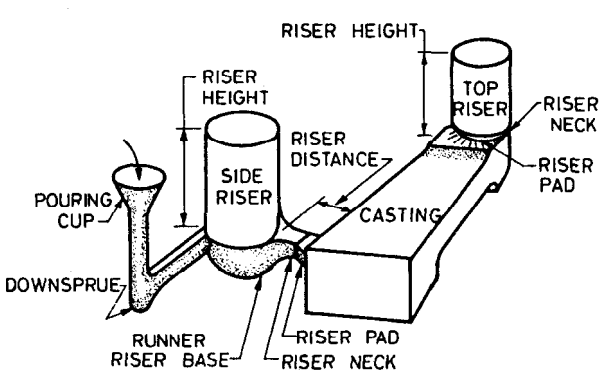


FIG. 70 RISER

Riser Blind — A riser which does not break through the top of the cope mould, and is entirely surrounded by sand, often combined with spin gates, and together forming an efficient method of gating and feeding a casting. The advantages are:

a) The hottest metal is in the riser and the coldest is in the casting. This promotes directional solidification;
b) Considerable lattitude is allowed in positioning blind riser;
c) A blind riser can be smaller than a corresponding open riser; and
d) Blind risers can be removed from a casting more easily than open riser.

Riser Gating — *See* 'Feeder head gating'.

Riser Height — *See* 'Feeder head height'.

Riser Neck — *See* 'Feeder neck'.

Riser Pad — *See* 'Feeder pad'

River Sand — Foundry sand occurring in deposits associated with river.

Rodding — Reinforcing sand in a core with metal rods or shapes to strengthen the parts of core.

Rolling Over — The operation of reversing the position of flask in which drag part of pattern has been rammed with the parting surface downward.

Roll-Over Board — A wood or metal plate on which pattern is laid top face downward for ramming the drag half of mould, the plate and half mould being turned over together before joint is made.

Roll-Over Machine — A moulding machine with which flask is rolled over before pattern is drawn from the mould.

Rotary Furnace — A furnace for preparing molten-metal for chill or malleable castings.

Rosette Graphite — Rosettes are formed from graphite flakes developing radially from a crystallization centre; there are first short and fine flakes, then longer and coarser ones. They are generally found in rapidly solidified iron (thin castings or near the surface).

Rough Casting — Casting conformable to the rough casting drawing.

Runner — A channel through which molten-metal or slag is passed from one receptable to another; in mould, the portion of gate assembly that connects downgate or sprue with casting ingate or riser. The term also applied to similar portions of master patterns, pattern die, patterns, investment mould and finished casting.

Runner Box — Device for distributing molten-metal around a mould by dividing it into several streams.

Runner Riser — A conventional runner, usually in horizontal plane, which permits flow of molten-metal to ingate and is large enough to act as reservoir to feed casting.

Runout — A casting defect caused by incomplete filling of mould due to molten-metal draining or leaking out of some part of mould cavity during pouring; escape of molten-metal from furnace, mould or melting crucible.

S

Safety Bar — In pressure die casting, the spacer-like steel bar between the front and moving platens of the die casting machine when the latter is open; it prevents it from closing to protect the operator from injury.

Safety Cap — A metal, leather or plastic head-dress, used to protect the head.

Safety Door — Metal guard opposite the joint face of the mould prior to injection and which is movable on the operator's side to provide easy access to the mould.

Safety Gaiters — Leather or asbestos linen coverings used for protecting legs against metal splatterings.

Safety Gloves — Gloves made of leather, asbestos, rubber or other suitable material plain or metal faced, for the protection of the hands against cuts, heat, acids etc.

Safety Goggles — Shatterproof, side-shielded eye protectors of non-magnifying or prescription lenses to prevent permanent injury to eyes or temporary loss of use. Wearing is mandatory for all personnel in specified work areas in most foundries.

Safety Shoes — With build-in steel toe caps, or with steel soles inside the leather ones.

Safety Wedge — Metal part incorporated in the mould, which, during injection, prevents backward movement of the movable parts parallel to the joint plane (*see* 6 of Fig. 4).

Sag — A decrease in metal section in casting due to sagging of cope or core.

Sand — A loose, granular material resulting from disintegration of rock. The term sand refers to size of grain and not to mineral composition. Diameter of individual grains can vary from approximately 6 to 270 mesh. Most of foundry sands are made up principally of mineral quartz (silica). The following are the different types of sands used in foundry:

a) *Artificial Sand* — Product resulting from crushing rock to desired size of sand grains.

b) *Bank Sand* — Sedimentary deposits usually containing less than 5 percent clay.

c) *Dune Sand* — Wind-blown deposits of sand found near large bodies of water.

d) *Moulding Sand (Natural)* — Sand which contains over 5 percent natural clay, usually between 10 and 20 percent.

e) *Miscellaneous Sand* — Includes zircon, olivine, sandstone, black sand (lava grains), titanium mineral, etc.

f) *Silica Sand* — Although majority of foundry sands contain a high percentage of silica, the term silica sand is generally reserved to those having 90 percent or more of silica.

Sand Bed — *See* 'Casting bed'.

Sand-Blast Lance — Fairly long tube to which is fastened the sand-blast nozzle and whereby the sand blast is aimed as required.

Sand-Blast Nozzle — Conical nozzle from which the fluid/sand blast mixture is blasted at high speed.

Sand-Blast — To remove sand by blasting an abrasive.

Sand-Blasting Barrel — A drum in which castings are subjected to sand blasted through one or several nozzles.

Sand-Blasting Cabinet — Small cabinet for sand-blasting and shot blasting. Its operator works from the outside, his hands and arms being protected by sleeves with glove extensions.

Sand-Blasting Chamber — Chamber where sand-blasting is carried out.

Sand-Blasting Equipment — Equipment for removing sand still adhering to shaken-out castings.

Sand Casting — A casting produced in a green sand, dried sand, or core sand mould.

Sand Coolers — Variously-designed equipment that thoroughly mixes the sand and the blown-in air, thereby dissipating the heat held in the sand by moisture-laden air.

Sand Cutter — A machine used to break down, aerate, reduce bulk density and generally improve the moulding properties of sand.

Sand Feeder — An apparatus for conveying sand from one place to another.

Sand Frame — Frame placed on the box and intended to contain the quality of loose sand which after ramming will permit the box to be filled completely.

Sand Hardness — The ability of a mould or a core to

resist penetration, scratching or abrasion. As far as penetration is concerned by the diameter of the impression of a ball of given diameter applied under a known load by means of a calibrated spring.

Sand Inclusions — Sand which has loosened from mould and become entrapped in the molten-metal.

Sand Mixer (Batch) — Machine for mixing non-clayey sands, comprising kneader arms which thoroughly mix the various previously proportioned constituents.

Sand Mixer (Continuous) — Machine for mixing non-clayey sands, comprising one or two mixing screws as well as a pumping system for distributing and proportioning the bonding agents.

Sand Reconditioning — A series of operations carried out to restore to the sand, after casting, its initial qualities.

Sand Reclamation — Processing of used foundry sand by thermal, mechanical, air or hydraulic methods so that it may be used in place of new sand without substantially changing current practice.

Sand-Skin Hardening — Hardened skin of a bulk of sand through physical or chemical change of some of its elements.

Sand Specimen — Sand sample shaped for testing.Typical examples; for compressive, tensile, bending and shearing tests.

Sand Testing (1) — Routine measurement of the properties and features of foundry sands which, if required, are rectified to maintain uniformly. Testing takes place upon delivery of new sand and when in use.

Sand Testing (2) — Physical and physico-chemical testing of the properties of moulding and core sand to determine mechanical properties, proportioning of constituents, mouldability, a.s.o.

Scab — A defect on the surface of a casting which appears as a rough, slightly raised surface blemish, crusted over by thin, porous layer of metal under which is a honeycomb or cavity that usually contains a layer of sand; defect common to thin-walled portions of casting, or around hot areas of the mould.

Scaffold, Cupola — The condition arising in furnace shaft when the descent of material is arrested by jamming.

Scaling — Surface oxidation caused on metals by heating in air or in other oxidizing atmosphere.

Scarfing — Cutting off surface projections such as gates and risers from castings by means of gas torch.

Scars/Seams — Groove resembling crease marks on the casting surface extending in a series of wavy lines, but of no great depth; the two edges of these grooves are at the same level.

Scrap — Metal to be remelted in foundry it generally includes sprues, gates, risers, defective castings, scrapped machinery, and fabricated items, such as rail or structural steel.

Screen — A perforated metal plate placed between gate and runner of a casting mould for the purpose of separating entrapped oxides, slag, etc, during pouring (*see also* 'Skim gate').

Screeve — A cut round the mould joint face made by a trowel to produce a seal.

Sealing — Plugging leaks in casting by introducing thermosetting plastics into porous areas and subsequently setting the plastic by heat.

Seger Cones — Set of pyrometric cones designed by Hermann Seger, each number of which tallies with a definite temperature, for example cone 32 = 1 710°C.

Segregation — In a casting, concentration of alloying elements at specific regions, usually as a result of primary crystallization of one phase with the subsequent concentration of other elements in the remaining liquid. Microsegregation refers to normal segregation on a microscopic scale whereby material richer in an alloying element freezes in successive layers on the dendrites (coring) and in the constituent network. Macrosegregation refers to gross differences in concentration (for example, from one area of a casting to another) which may be normal, inverse or gravity segregation.

Self-Curing Binder — *See* 'Airset binder'.

Self-Hardening-Sand Moulding — A moulding process involving a sand bonded by either organic or mineral binders, which, depending on the amount of catalyst added while being blended sets within from 5 to 150 minutes. Packing is carried out conventionally by filling and ramming.

Semi-Centrifugal Casting — Centrifugal casting process where the single axis of symmetry of the casting coincides with the axis of rotation and where all the cavities are derived by coring.

Semi-Synthetic Sand — Natural moulding sand containing less than 8 percent clay, which therefore has to be enriched in bentonite or in some other materials in order to become suitable for moulding purposes.

Shake-Out — Removing the castings from the mould.

Shake-Out Machine — Machine for knocking out.

Shaker-Grate Furnace — Calcining furnace in which the sand to be reclaimed is laid on a perforated hearth actuated by a to-and-fro motion.

Shear Strength (Sand) — This is the unit of sectional load that fractures a cylindrical test specimen subjected to a shearing stress along a plane passing through its axis of revolution.

Shear Test — Test consisting of submitting a test piece to a force causing two adjacent planes to slide against each other until fracture occurs. The shear strength can also be obtained by a torsion test on a cylindrical bar.

Shearing — The process of cutting off gates from castings.

Shell Core — A thin hollow core made up with a compound of silica sand and a suitable binder quickly hardened by suitable means when in contact with the core box.

Shell Mould — A thin mould made from resin bonded sand mixture brought in contact with pre-heated metal patterns.

Shell Moulding (Croning Process) — A process of making mould from resin-bonded sand mixtures brought in a contact with pre-heated (150 to 180°C) metal patterns, resulting in a firm shell with a cavity corresponding to the outline of pattern.

Shell Moulding Machine — Machine used to prepare shell moulds.

Shell Pattern — Pattern with a form similar to that of the casting even if the latter exhibits undercuts and for this reason it is necessary to use special devices for executing the mould, for example installing several false cores.

Shift — A casting defect caused by mismatch of cope and drag or of cores and mould.

Shockless Jolt Moulding Machine — A machine in which the jolt bringing about the ramming action takes place on a movable spring-loaded spot anvil.

Softness — A term loosely applied in a foundry to indicate brittleness in metal.

Short Run — In complete filling of mould through insufficient quantity of molten-metal.

Shot and Grit — These two terms refer to metallic type of abrasives commonly used for cleaning castings. The shot is formed by blowing hot metal into a quenching tank and subsequently screening into various sizes. The grit is produced by breaking up the shot particles in either a ball or hammer mill.

Shotblasting — A process of cleaning casting, it utilizes metal abrasive particles (grit or shot) propelled by pneumatic or centrifugal force.

Shotblasting Machine — Machine using centrifugally thrown shot to clean castings.

Shot Peening — Shotblasting with the precise object for superficial hardening of a metal.

Shrinkage Cavity (Shrinkage, Hole, Draw) — A void left in cast metals as a result of 'solidification shrinkage' and the progressive freezing of metal towards the centre.

Shrinkage Cracks — Cracks that are formed in metal as a result of pulling apart of grains by thermal contraction before complete solidification.

Shrinkage, Patternmakers' — A scale divided in excess of standard measurement to allow for difference in size between casting and corresponding mould cavity; used by patternmakers to avoid calculations for shrinkage of molten-metal during solid stage.

Shrinkage, Process — It refers to total corrections for shrinkage that normally occurs during the making of precision investment casting and which is applied to the master pattern.

Shrinkage, Solid (Contraction, Solid) — The continued contraction with decreasing temperature which takes place after solidification of metal. The rate of contraction may be influenced by transformations occurring in solid state.

Shrinkage Spalling — Shearing off of refractory from stresses set up within the refractories by shrinkage of exposed face.

Sieve — *See* 'Screen'.

Sieve Analysis/Screen Analysis — Distribution of particle size sand expressed in term of the percentage of weight retained on each of a series of standard screen decreasing in mesh size.

Silica — Silicon dioxide (SiO_2), the prime ingredient of sharp sand and acid refractories.

Silica Brick — Refractory high silica material bonded with hydrated lime and fired at high temperature.

Silica Flour — Material commonly produced by pulverizing pure grains of quartz sand in large ball mills. In analysis, it is at least 98.0 percent pure silica, and is commonly used in steel foundry for improving finish and increasing hot strength of moulds. It is also used in the production of core and mould washes.

Silica Gel — A colloidal form of silica used as a drying agent.

Silica Sand — Quartz sand the fractional size distribution of which, lower than 20 microns, does not exceed 4 percent.

Silicate — Compound originated from combination of silica (SiO_2) with one or several metal oxides.

Silicate Sand — Sand used for moulding or coring, the binder of which is sodium-silicate based.

Sillimanite/Fibrolite — A silicate of aluminium ($Al_2O_3.SiO_2$) which alters to mullite and free silica at temperature of 1 550-1 627°C with slight volume expansion.

Silicious Clay — Clay containing high percentage of silica.

Silt — Very fine particles that are finer than 0.06 mm and coarser than 0.002 mm.

Silvery Pig Iron — Pig iron with a very high silicon content; 7 to 17 percent Si.

Single-Piece Pattern Plate — Single-sided pattern plate upon which both follow, plate and pattern, with their ancillaries, have been cast integral.

Single-Sided Pattern Plate — Pattern plate permitting only one part of the mould to be executed (top or bottom).

Sink Head — A riser or feeding head.

Sink Marks — Depression in the casting surface at heavy metal sections (intersections, etc) or at the bottom of an internal shrinkage cavity or porous area.

Sintering — Agglomeration by heating of solid particles.

Sintering Point — That temperature at which the moulding material begins to adhere to casting, or in a test when sand coheres to platinum ribbon under controlled conditions. Also, the temperature at which sand grains begin to adhere to each other.

Sizing — Primary coating of very thin glue given to end grains of wood to seal the pores.

Skeleton Pattern — A framework or skeleton of ribs representing the interior and exterior form and the metal thickness of the required casting.

Skim (1) — To remove the scum.

Skim (2) — Push back, or alternately, remove all or part of foreign matter floating on the metal bath.

Skim Gate — A gating arrangement which changes the direction of flow of molten-metal and prevents passage of slag and other undesirable material.

Skim Strainer — Thin metal disc or strip placed in the pouring basin at the top of downsprue. It delays the flow of metal long enough to allow the basin to fill before it melts to permit only clean metal from the bottom of the basin to enter downsprue. Delay screens (discs) may also be used elsewhere in the gating system.

Skimmer — Tool used for skimming.

Skin — A thin surface layer that is different from main mass of a metal object in composition, structure or other characteristics.

Skin Dry a Mould — To dry the mould surfaces superficially by means of a flame before casting.

Skin-Drying — Drying the surface of mould by direct application of heat.

Skip Hoist — A basket, bucket, or other container which may be drawn or elevated on rails by pulling action used for charging materials into the cupola.

Skull — A layer of metal or dross on the walls of a pouring vessel after metal has been poured out.

Slag — A non-metallic covering on molten-metal formed from impurities in furnace charge, fuel ash, refractory lining and international flux additions.

Slag-Blowhole Defect/Scum/Foaming — Non-metallic inclusions which are usually associated with blowholes within the inclusions as well as in the mass of the casting.

Slag Hole (Cupola) — An opening in front or back of cupola through which the slag is drawn off.

Slag Inclusions — By precision investment cast steel, small, rounded cavities often greenish grey in colour.

Slag Notch — That portion in a front-slagging cupola spout over which slag flows. In case of furnace it is the place over which the slag is skimmed, rabbled, or tapped.

Slag Wool — A wool-like material produced by blowing air over the top of the slag bath.

Slagging-off — To remove slag from a metal bath or ladle.

Slaked Lime — Calcium hydroxide formed by the action of water on quicklime.

Sleeker/Slick — Metal tool serving to smooth the sand of the mould.

Sliding Core — Sliding member in the mould, driving a core or a portion of an undercut cavity.

Slinger Moulding Machine/Sandslinger — Movable or fixed machine which effects ramming by a jet of sand created by an impeller.

Slip Casting — A method of casting mould slurry in a prepared master mould.

Slip Jacket — A wooden or metal frame which is slipped over a mould after removal of the snap or slip flask to support the four sides of the mould during pouring.

Sludge — Accumulation of oxidized elements heavier than the base melt that settle to the bottom of a crucible or furnace.

Slurry — Liquid or slightly viscous mixture composed of a binder, eventually a solvent, and a fine refractory powder. It is used for coating disposable patterns by the dipcoating process.

Slush Casting — A casting made from an alloy that has a low melting point and freezes within a wide range of temperature. The metal is poured into mould, and brought into contact with surface so as to form a shell of frozen metal; then excess metal is poured out. Casting that consists of completely enclosed shells may be made by using a definite quantity of metal and a closed mould.

Soda Ash — Commercial grade sodium carbonate, used principally to desulphurize metal and to make a more fluid slag.

Soft Cast Iron/Machinable Cast Iron — Cast iron which is easily machinable.

Solubility — Ability of a substance or a phase to enter into solution in another substance or phase.

Sorbitic Cast Iron — Cast iron with matrix constituted of sorbite.

Sow — The result of a superseded method in which iron was cast into a main sand channel from which the stream of molten-metal flowed; from it ran off lateral pigs.

Spark Arrester — A device to prevent the emission of hot flying particles, positioned in front of the slag-discharge hole of a cupola furnace or in the cupola stack.

Specification — Statement of conditions that defined goods have to comply with.

Spheroidal Graphite Cast Iron — *See* 'Ductile cast iron'.

Spheroidization — Transformation process during which constituents of any shape whatever become spheroidal in shape.

Sprue — Vertical channel connecting pouring basin with skimming gate, if any, and runner to mould cavity, all of which together may be called gate.

Sprue Pin — Insert opposite the sprue hole, used to direct the metal towards the feeders and reduce the size of the spruc (*see* 7 of Fig. 4).

Sprue Plug — Wood or metal tapered roll or pin used to form a sprue opening, or a metal plug left in sprue after pouring has begun to allow the filling of pouring basic before metal is allowed to enter the sprue (Fig. 71).

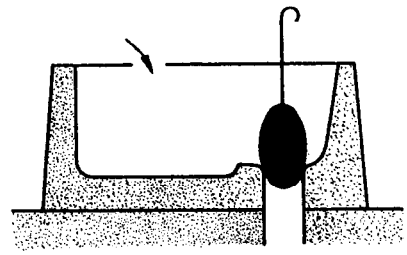


FIG. 71 SPRUE PLUG

Squeeze Moulding Machine — Machine depending solely on pressure for ramming the sand generally limited to shallow box parts.

Stack Casting — Special moulding procedure for pouring stacked multiple moulds comprising a main vertical channel (the downgate) connected to as many horizontal runners as the mould comprises joint faces (or of stacked castings in an investment pattern mould).

Stack Moulding — A moulding method which makes use of both sides of one half mould, one side acting as the drag and the other half as the cope, all the castings being poured through a common downsprue. Refers also to pouring a number of complete moulds, stacked one upon another and fed by a common downsprue.

Stainless — Quality of an alloy or metal resistant to the action of certain oxidizing conditions. The property is the consequence of surface modifications resulting in a protective layer.

Standard — Specification that have been set up by a public institution or a group of private enterprises.

Static Casting — Pouring metal into a stationary mould, as opposed to a moving mould, as centrifugal casting for instance.

Steel Foundry — Foundry where steel castings are produced.

Steel Mix Cast Iron/Semisteel — Low carbon resistant cast iron, generally obtained by adding steel to the charges (term now seldom employed).

Steel Rule — A flexible, graduated steel rod, used to take linear measurements.

Stepped Side Gate — Pouring system designed to convey molten-metal direct into the feeding heads, as bottom casting ends (*a*) (Fig. 72).

Stepped Sprue — Downgate passing through the section of a multiple-part mould in horizontally staggered at the level of several joint faces (*a*) (Fig. 73).

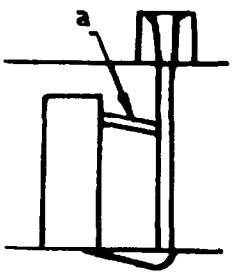


FIG. 72 STEPPED SIDE GATE

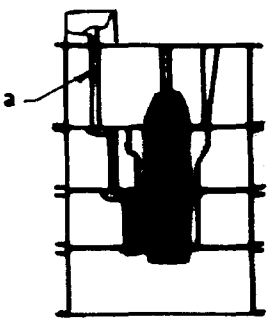


FIG. 73 STEPPED SPRUE

Stool — Support for crucible in crucible furnaces.

Stop Button — *See* 'Ejector plate stop'.

Stopper Head — A refractory shape, usually refractory brick or graphite seated in a nozzle brick.

Stopper Rod — A device in bottom-pour ladle for controlling the flow of metal through nozzle into casting. The stopper rod consists of steel rod, protecting sleeves, and graphite stopper head.

Straightforward Stripping — Mechanical stripping of the pattern plate or core box, direct from their rammed position, either by lowering the pattern or raising either mould or core.

Strained Casting — *See* 'Cope raise'.

Strainer (Strainer Core) (Filter Core) — A gate designed to prevent slag and direct from entering the mould and also to control the rate at which metal enters the mould cavity (*see* Fig. 74).

Strength, Retained — It is the strength that sand mixture retains after it has been subjected to a cycle or cycles of heating and cooling which approximates the actual foundry practice.

Strickle (Strike) — A tool with a straight or curved edge used for removing excess sand from a flask or to form desired outline of a mould.

Strike-off — Operation of removing excess sand from core box or flask.

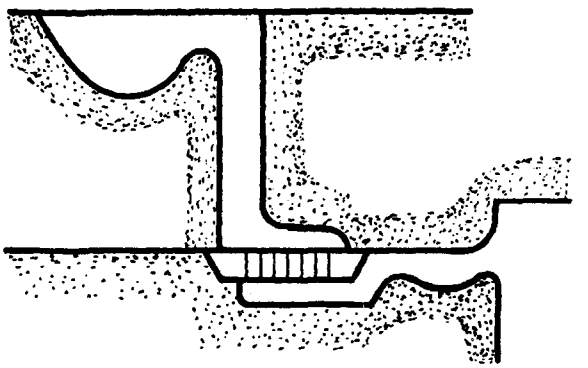


FIG. 74 STRAINER

Strickle Core Box — Coffer type box designed so that part of the core is executed by strickling.

Strickle Moulding — Making a mould or core requiring strickling operations.

Stripping — Operation consisting of separating the mould from the pattern or pattern-plate or removing the core from its box.

Stripping Machine — A device for removing pattern from mould, or core from core box.

Stripping Plate — The plate which holds sand in place while the pattern in drawn vertically through the plate.

Structural Spalling — Breaking-off of refractories from repeated unequal heating at high temperature.

Sub-Surface Pinholes — Small cavities often of the size of the head of a pin located in more or less extended colonies across the casting surface and having one of two forms.

- generally spherical cavities which are removed by machining 1 to 2 mm (surface pinholes);
- elongated (teardrop or rod-shaped) cavities which may appear only after machining an apparently sound surface or after heat treatment or it small holes seen originally on the cast surface become larger after machining (sub-surface pinholes).

Subzero Treatment — Quenching performed at temperatures below 0°C.

Suction Conveyor — Equipment used to convey powdery materials by suction.

Sulphur Dome — An inverted container holding a high concentration of sulphur dioxide; used over a pot of molten magnesium in connection with die casting of magnesium.

Supercooling/Undercooling — It can happen that on cooling a liquid metal or alloy the solidification does not take place even under the solidification point or under the liquidus. This circumstance is known as undercooling or supercooling. It is a state of unstable equilibrium.

Superduty Fireclay Brick — Having pyrometric cone equivalent (PCE) above 33 with less than 1.0 percent linear shrinkage in the 1 600°C reheat test, and less than 4.0 percent loss in panel spalling test pre heated at 1 650°C.

Superheat — Difference between the temperature to which a metal has been subjected and at which it melts or finishes melting.

Surface or Sub-surface Blowholes — Cavities whose walls are generally smooth and rounded, often in the form of flattened bubbles with rounded or angular corners located either singly or in groups at or near the surface of the casting.

Swab Brush — Round short brush used for moistening edges of mould cavity.

Sweat — The appearance on the surface of a solid mass of cast metal, usually in the form of small globules, of a constituent that has a relatively low melting point, for example, in case of copper-base alloys, tin or lead sweat is observed at times.

Sweep — Template cut to the profile of desired mould shape, which when revolved around a stake or spindle, produces that mould.

Sweep-Work — Moulds made by using pieces of patterns and sweeps instead of patterns.

Swell — A casting defect consisting of an increase in metal section due to displacement of sand by metal pressure.

Swing Grinder — A device for grinding large castings where the work remains stationary. This grinder, too large to be hand lifted, is usually suspended from a hoist.

Synthetic Cast Iron/Synthetic Pig Iron — Cast iron or pig iron obtained through carburization of steel charges. Generally in an electric furnace.

Synthetic Magnesite — Magnesite made by a chemical process from sea water or other brines.

Synthetic Moulding Sand — Any sand compounded from selected individual materials which, when mixed together, produces a mixture of proper physical and mechanical properties with suitable binder to make foundry moulds.

Synthetic Resin — An organic high molecular compound derived through polymerization or polycondensation of smaller molecules. A synthetic resin may be either thermoplastic or thermosetting. Apart from phenolic resins for shell moulds which, in the initial stage, are thermoplastic, all resins for foundries are thermosetting are used in this industry as binders jointly with various activators and, occasionally, either with catalysts or in conjunction with a temperature rise.

Synthetic Sand Mixture — Sand prepared from sharp or unbonded silica sand by the addition of bonding agents such as bentonite, dextrin, molasses, starch, resins, oils and proprietary mineral clays. Also silicate bonded sand as used in the carbon dioxide sand process.

Syphon Runner — Ancillary gate comprising a syphon ahead of the gate proper (*a*) (*see* Fig. 75).

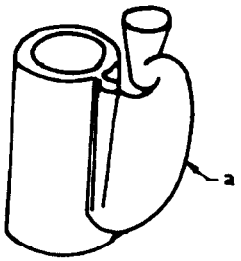


FIG. 75 SYPHON RUNNER

T

Tangential Gate — Controlled ingate tangential to the side of a casting so as to convey a gyratory motion to the alloy in the cavity (*a*) (Fig. 76).

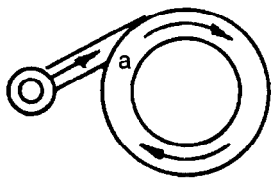


FIG. 76 TANGENTIAL GATE

Tally Mark — A mark or combination of marks indicating proper location of a loose piece of a pattern or core box.

Tamping — The process of packing investment filler around the pattern and removing air pockets from the investment by vibration.

Tap Hole — Opening in furnace breast through which molten-metal is tapped into spout.

Tap Hole Plug Stick — *See* 'Bott stick'.

Tapping — Removing molten-metal from melting furnace by opening tap hole, allowing metal to run into ladle.

Teapot Ladle/Teapot Spout Ladle — A ladle in which, by means of an external spout, metal is removed from the bottom rather than the top of the ladle (Fig. 77).

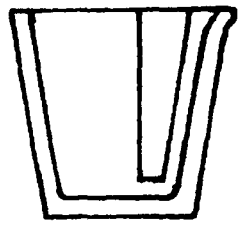


FIG. 77 TEAPOT LADLE

Temper (1)—The moisture content of sand at which any certain physical test value is obtained, that is temper with respect to green compressive strength, permeability, retained compressive strength, etc.

Temper (2)—Mixing sand with sufficient water or other liquid to develop desired moulding properties.

Temperature Gradient — Temperature difference between two or more locations expressed in degrees per unit of distance.

Temperature, Holding — Temperature above critical range at which castings are held as a part of heat-treatment cycle. The temperature maintained when metal is held in furnace, usually prior to pouring.

Temperature, Pouring — The temperature of the molten-metal when it is poured into the mould.

Temper Carbon — The free or graphitic carbon that precipitates from solution usually in the form of rounded or equi-axed nodules in the structure during graphitising or malleablizing of white cast iron.

Temper Water — Water added to sand to give proper moulding consistency.

Template Moulding — *See* 'Strickle moulding'.

Tensile Strength (Sand) — The tensile strength of a hardened sand is the unit of sectional load that fractures a suitably shaped test specimen subjected to a tensile stress passing through its axis of revolution.

Thermal Shock — Violent variation of the temperature of a solid body.

Thermal Spalling — Breaking up of refractory from stress which arise during repeated heating and cooling.

Thermocouple — Paired alloys making up a closed circuit comprising at least two welds or contact points between which may develop a potential difference. If they are at different temperatures. Such potential difference depends on the temperature differential.

Thermocouple Sheath — A sheath or end-piece for protecting a thermocouple against attack by the medium with which it may come in contact.

Thermoplastic — Having the property of softening on heating and hardening on cooling for indefinite number of times.

Thermosetting — Having the property of becoming permanently hard when heated, for example, foundry synthetic resins.

Thermosetting Binder — Binder that sets through application of heat: drying, bake-out or contact with heated tool equipment.

Thermostat — An automatic device for keeping temperature virtually constant and which, via a relay, controls the switch that turns on and off the source of heat.

Thixotropy — The property of such gels as bentonite to become fluid when agitated and gelling when allowed to stand.

Tie Bar — *See* 'Column'.

Tie-Rod — A metal rod, threaded both ends, bearing against the anchoring cross members and fitted with clamping nuts.

Tilt Casting — Process consisting initially in pouring the molten-metal into a tilted mould and progressively righting same as filling proceeds.

Tin Coating/Tinning — Any process of depositing a film of tin on the surface of an object to protect it against corrosion or to facilitate soldering.

Tolerance — Difference between two permissible limits of size for which a part still meets its purpose, This purpose may obviously be the possibility to obtain by machining a part of given size.

Tongs/Lifter — Handling tool with two articulated claws allowing objects of generally cylindrical shape to be held (crucibles billets, barrels, etc.) (Fig. 78).

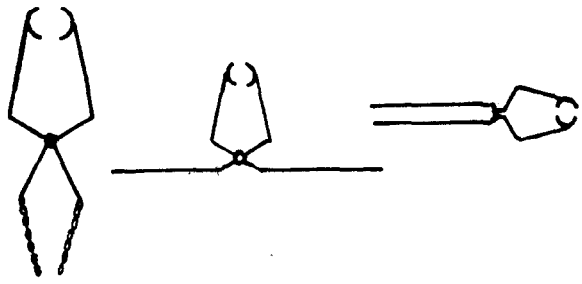


FIG. 78 TONGS

Top Casting/Top Pouring — Pouring procedure whereby the metal is poured from the top.

Top Feeder/Top Riser — A feeder attached to the top surface of a casting (*a* and *b*) (Fig. 79).

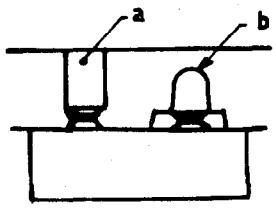


FIG. 79 TOP FEEDER

Total Carbon — Total quantity of carbon (combined and free) existing in an iron.

Total Melting Loss — This is the difference in weight between the amount of metal or alloy charged for melting and the amount of metal or alloy collected.

Tramp Element/Trace Element — A chemical element such as zinc, boron, copper, etc, found combined in minute quantities in the metal. As a rule is not estimated quantitatively but likely to affect extensively some properties of the metal.

Tramping — Ramming by stamping (with the feet) on the sand, in a mould of low height.

Tridymite — Form of silica stable between 870°C and 1 470°C.

Triplexing/Triplex Process — A melting practice involving the transfer of molten-metal from one furnace to another and finally to a third furnace before pouring.

Troughed Core Box — Box in which the internal elements giving the form of the core are placed in a trough with tapered sides; they are retained in place by reciprocal wedging (Fig. 80).

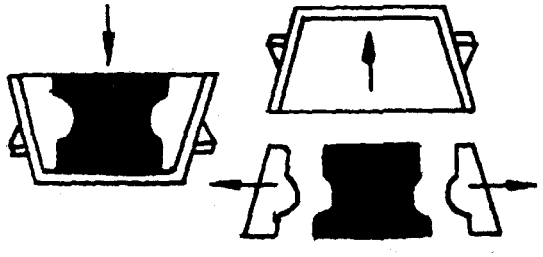


FIG. 80 TROUGHED CORE BOX

Trowel — A tool, consisting of a steel blade of appropriate shape and extended by an offset rod fitted into a handle.

True Centrifugal Casting — Centrifugal casting where the axis of the casting coincides with the axis of rotation and where the thickness of the casting is determined by the dimensions of the mould and the amount of metal cast. The said axis may be vertical, horizontal, or oblique.

Tucking — Pressing sand with the fingers under flask bars, around gaggers, and other places where the rammer does not give the desired density.

Tumbling — Cleaning castings by rotating them in a container in the presence of cleaning materials.

Tumbling Barrel — A revolving barrel in which the sand still adhering to shaken-out castings is removed by whirling same and so brought into vigorous frictional contact.

Tundish — A refractory lined vessel which may be interposed between the ladle and the mould in teeming. It may have more than one hole to control metal flow.

Tuyere — An opening in cupola shell and refractory lining through which air blast is forced (*see* Fig. 16)

Tuyere Ratio — The ratio of tuyere area to combustion zone area.

U

Unburned Brick — Brick not fired in a kiln; sometimes chemically-bonded .

Undercooled Graphite — In irons showing a net of dendrites the liquid remaining between the first solidified branches is richer in carbon than would result from the equilibrium diagram. This liquid solidifies at a temperature lower than the equilibrium temperature; in other words it has been undercooled; when it finally solidifies its carbon appears as small flakes in the interdendritic spaces; these flakes are termed 'undercooled graphite'.

Uneven Ramming — Irregular ramming of the sand on one or more limited zones of the impression.

Uniform Runner — Runner the cross-section of which decreases from the input to the output side.

Unit Die — Special tool with several small moulds independent of one another — or interchangeable moulds — and with principal elements which are standard.

Unit of Crucible Capacity — Corresponding generally to 1 lb of molten copper.

Unit Sand — Moulding sand used either as facing and baking sand.

Urea Formaldehyde Resin — A thermosetting product of condensation from urea or thio-urea and formaldehyde, soluble in water and used as a sand binder in cores and moulds.

V

Vacuuming — In investment casting, the process of removing air pockets from investment or precoat slurry before and/or after investing, by subjecting the mixture to a vacuum.

Vacuum Casting — Casting in an evacuated enclosure in which the mould was previously placed. This process is usually associated with melting in vacuum the metal involved.

Vacuum, Consumable Electrode Furnace — Uses the metal to be melted as an electrode, by striking an arc between this metal and a molten bath. As the electrode is consumed in melting it feeds in solid charge automatically.

Vacuum Degassing (1) — Melting in a vacuum, by induction or electric arc, to remove gaseous contaminants from the metal.

Vacuum Degassing (2) — Use of vacuum technique to remove dissolved gases from molten alloys.

Vacuum Die Casting — *See* 'Evacuated die casting'.

Vacuum Melting — Melting operation conducted in vacuum.

Vacuum Moulding Process — A moulding process involving a silica sand with no binder. Packing is achieved by the sand flowing by gravity in a sealed moulding box laid on a pattern plate covered with a thin plastic sheet, applied by suction, and which conforms to all the contours. Hardening is obtained on applying a vacuum to the moulding box the top of which is closed by another plastic sheet, stripping being performed subsequently while keeping up the vacuum.

Vaporizable Lost-Pattern — A pattern that vanishes by vaporization.

Vegetable Oils — Oils extracted from plants, used as drying oils in core oil manufacture. Linseed oil is an example.

Veining — A defect on the surface of a casting appearing as veins or wrinkles and associated with excessive thermal movement of sand, especially core sands.

Vent — A small opening or passage in a mould or core to facilitate escape of gases when mould is poured.

Vent Board — Board for directing air circulation on to the core joints.

Vent, Core Box — A finely grated opening to permit the escape of compressed air used in blowing a core.

Venting — Perforation sand over and around a mould cavity by a venting wire to assist in escape of gases.

Vent Former — Air intake opening provided on a pattern print or a core box.

Vent Rods — Rods used to make a passage in the mould for escaping gases.

Vent Wax — A flexible wax taper inserted into intricate cores during production when the core dries the wax melts and leaves a vent.

Vermicular Graphite — Graphite in the form of worms of irregular sizes and appearing as intermediate between lamellar and spheroidal graphite.

Vertical Casting — Casting method in which the mould joint is vertical.

Vibrating Sieve/Vibrating Screen — A type of device in which the sieve are vibrated.

Vibrating Table — A device upon which flasks are vibrated in investment casting to remove air bubbles and to make investment more dense.

Vibration Ramming — Ramming obtained by the inertia of a sand submitted to movements of high frequency and low amplitude.

Vibrational Casting — A casting operation in which the mould or the metal is vibrated during cooling and solidification.

Vibratory Moulding-Machine — Machine which uses vibration at various amplitudes to promote the desired location of sand during the ramming operation.

Vice — A tool, with two jaws for holding work, that usually closes by a screw, lever or cam.

Virgin Metal — Metal extracted from the ore without addition of any scrap.

Void — A hole or cavity in a casting resulting from contraction and insufficient feed metal and formed during the time the metal changes from the liquid to the solid state. It is localized in zones which are the last to solidify.

W

Wafer Core — Core which is generally thin in relation to its surface.

Warping — *See* 'Bulging'.

Washburn Core — A thin core which constricts the riser at the point of attachment to casting. The thin core heats quickly and promotes feeding of casting. Riser removal cost is minimized (Fig. 81).

Wash (Cuts) — A casting defect resulting from erosion of sand by metal flowing over mould or cores surfaces. They appear as rough spots of casting. Riser removal cost is minimized.

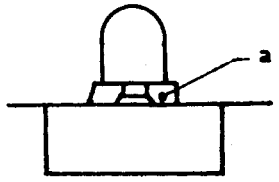


FIG. 81 WASHBURN CORE

Washed-Out Sand — Sand consisting solely of silica grains, the part lower than 20 μm of which have been partially or totally washed out.

Water-Cooled Cupola Furnace — Cupola furnace, the melting area of which and, where applicable, the tuyeres are cooled by water flowing:

a) in a water jacket, or
b) streaming down outside the slightly-sloping shell of the furnace.

Water Glass/Sodium Silicate — A mineral amorphous substance originated from compounding silica and sodium carbonate. In the form of water solutions it is used as a foundry binder whose features are its SiO_2/Na_2O ratio and solid matter content.

Waterless Moulding Sand (1) — A clayey sand the binder of which is bentonite so modified as to be water-repellent tempered with mineral oil or alcohol and not with water.

Waterless Moulding Sand (2) — Sand bonded by untreated clay and in which water is replaced by another polar liquid.

Wax — Common waxes are bees wax and paraffin wax.

Weak Sand — Sand lacking in proper amount of clay, bond or moisture. May be intentionally prepared to avoid cracking of intricate casting.

Wear Plate — Metal plate inserted on a part of the core box subject to wear, fixed on the joint of the box or on the assembly joints of the box parts, can be easily replaced.

Web — A plate or thin member lying between heavier members.

Wedge Pin — Pin with a socket, drilled in its axial plane, for insertion of a cotter (*a*) (Fig. 82).

Wedge Test Bar — A test bar of wedge shaped cross-section designed to show the effect of a differential rate of cooling during solidification of metal or a wedge test specimen used in malleable iron to determine the number of blows at a predetermined energy (in kgf.m) that can be exerted on the thin end before failure.

Weep Hole — An opening placed in casting to allow drainage of moisture.

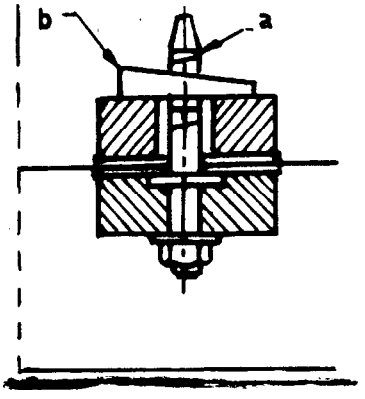


FIG. 82 WEDGE PIN

Weighting — Dead weight which is placed on cope to resist upward pressure of molten-metals.

Weigh a Mould — To place weights on a mould to compensate for the static and dynamic forces of the liquid metal.

Weldability — Ability of a material to be welded by appropriate methods without loss of resistance neither in the weld nor in adjacent regions. Weldability is tested through several normalized methods.

Wet Cap — A device installed on a cupola stack that collects emissions by forcing them through a curtain of water.

Wet Scrubber — In air pollution control, a liquid (usually water) spray device for collecting pollutants in escaping foundry gases.

Wetting Agent — A surface acting agent which causes material to be wet more rapidly, primarily because of reduction in surface tension of wetting agent.

Wing Core — A core below the mould joint and whose print extents to the latter.

Whirl Gate Dirt Trap — Cylindrical dirt trap incorporated in a gate and wherein the molten-metal is purposely whirled to remove the slag (*a*) (Fig. 83).

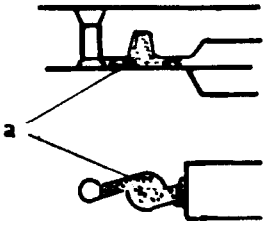


FIG. 83 WHIRL GATE DIRT TRAP

Whirl Gate Feeder/Whirl Gate Riser — Feeder-head gate the feature of which is that the molten-metal penetrates into it tangentially and keeps up there a gyratory motion.

White Cast Iron — Cast iron in which the carbon is predominantly present as iron-carbide.

White Metal — Alloy of tin and/or lead, with copper and antimony.

Wire-Cut Brick — Brick cut by wire from column extruded by auger machine and not repressed.

William's Core — A core placed in a blind riser so that metal within the riser is subject to atmospheric pressure, thereby eliminating establishment of partial vacuum within riser as the metal begins to solidify, the core acting as a passage for the ingress of air, thus promoting free flow of metal to feed the casting.

William's Riser — A type of riser that makes used of atmospheric pressure to aid in feeding. Essentially a blind riser in which a small core or rod protrudes whose function is to keep an air passage open.

Wind Box — The chamber surrounding a cupola through which air is conducted under pressure to the tuyeres and equalizing the volume and pressure of the blast; also double bottom of a converter connected by the tuyeres to the converter proper, receiving the wind from the blower (12 and 12 bis) (Fig. 16).

Wood Flour — Finely powdered wood chiefly used as an anti-scab additive, a shaking-out and de-coring agent as part substitute for sea coal.

Y

Yard — A storage area for equipment or raw materials.

Yield — *See* 'Casting yield'.

Z

Zinc Alloys — Zinc based alloys.

Zinc Coating/Galvanizing — Zinc coating may be obtained by electrodeposition, by dipping the part to be coated in a bath of molten zinc (hot dip galvanization) or by spraying.

Zircon — The mineral zircon silicate ($ZrSiO_4$), a very high melting refractory material, sometimes used as moulding material in steel foundries.

Zirconia — ZrO_2, an acid refractory up to 2 750°C having good thermal shock resistance and low electrical resistivity.

Zircon Sand — A very highly refractory sand of unusual fineness, lower thermal expansion and high thermal conductivity, exceedingly useful and efficient in foundry practice. It consists principally of zirconium silicate and is widely used for improving finish and preventing 'burning-in' of sand on casting surface.

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