DICTIONARY OF MECHANICAL ENGINEERING

ALFRED DEL VECCHIO

B.M.E., M.M.E., New York University
P.E., New York State

Associate Professor
Director of Mechanical Engineering
Manhattan College

PHILOSOPHICAL LIBRARY
New York

Library of Congress Catalog Number 60-13664

Printed in the United States of America

FOREWORD

This book is written for the practicing engineer, the student and teachers engaged in the fields of architecture, automatic controls, engineering mechanics, fuels and combustion, and power plants. Some definitions are also included in the related fields of electricity, heat treatment of metals, mathematics, and welding.

As Humpty Dumpty said to Alice in Wonderland, "When I use a word, it means just what I choose it to mean—neither more nor less." It is only natural that an inquisitive and active mind seek out precise definitions to scientific terms. Unfortunately, this is not always possible. Many scientific terms have three or more dimensions. It is difficult to depict in the mind's eye beyond the third dimension. Hence, the definitions in this category become intangible and must be presented as properties. For instance the term—*moment of inertia*—as used in architecture or engineering mechanics has units of inches to the fourth power $(in.)^4$. This is defined as *measure of the rigidity of a structural member*. There is no tangible definition here which can be depicted. Hence we must study the term as a property and content ourselves with the definition that it is a *measure* of something.

There are other needed definitions, not all covered in this work, which take a lot of explaining. *Tons of Refrigeration* has nothing to do with weight—*Boiler Horsepower* has nothing to do with horsepower—*Specific Gravity* has nothing to do with gravity. It is unfortunate that these terms were allowed to take hold, but as a science develops, it is only natural that there should be trouble with the meanings of words.

The author wishes to express his thanks to The Industrial Press, American Boiler and affiliated industries, Society of Automotive Engineers, and the American Society of Mechanical Engineers (Instruments and Regulators Division) for permission to quote their publications on definitions.

Alfred Del Vecchio

abbreviations used in this work

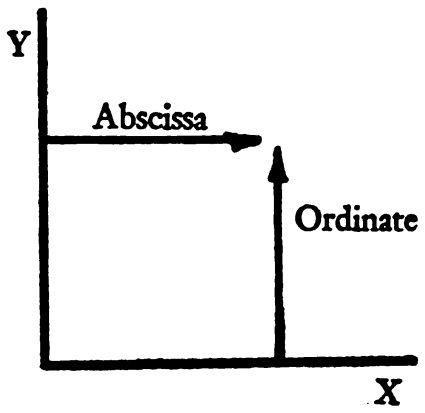
arch.–architecture
A.C.–automatic controls
E.M.–engineering mechanics
elect.–basic electricity
F.&C.–fuels & combustion
math.–basic mathematics
P.P.–power plants
weld.–welding

abrasive

Any rough material such as sandpaper, pumice, or emery, used for polishing, sanding, or grinding.

abscissa (math.)

The horizontal distance from the origin of a set of co-ordinates.



absolute humidity

The weight of water vapor in a gas water-vapor mixture per unit volume of space occupied, as, for example, grains or pounds per cubic foot. In an air-vapor mixture, the unit

usually given is grains of water vapor per pound of air or pounds of water vapor per pound of air.

absolute pressure

The pressure above zero pressure. The sum of the gage and atmospheric pressures.

absolute strength

The actual breaking strength of a bar or structure, as distinguished from the safe or working load.

absolute temperature

The temperature measured from approximately —460 degrees Fahrenheit, which is absolute zero.

abutment (arch.)

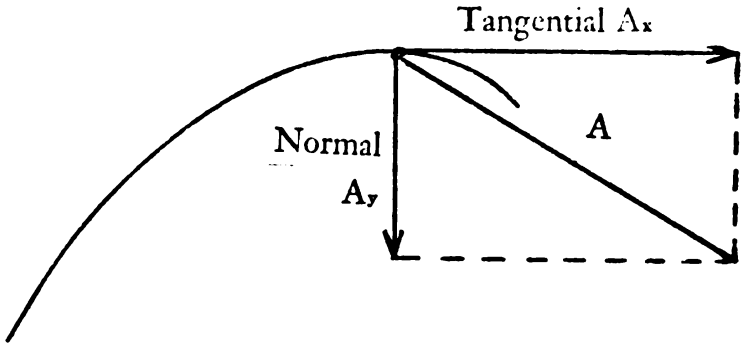
In architecture, it is that part of a pier, wall, buttress or any masonry structure which receives thrust, i.e. the part from which an arch springs. A bridge abutment is the supporting pier at the extreme ends of a bridge. Its function is to support the bridge and hold the adjacent earth in position. Thus it functions both as a pier and a retaining wall.

abuttals

The boundings of land on other land. Boundary.

acceleration (E.M.)

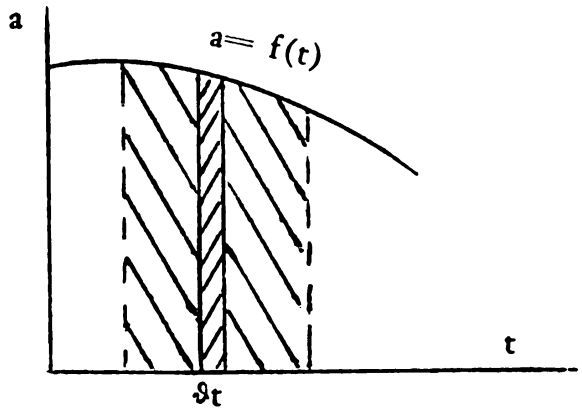
Acceleration is the ratio of the change in velocity of a body to the elapsed time. It is expressed mathematically by dv/dt. Since the velocity has direction and magniture, the acceleration must be treated as a vector. Acceleration may be rectilinear (straight line) or curvilinear (curved path). If the acceleration is along a curved path, it will have *tangential* and *normal* components at every point along the traveled path. The tangential component is directed tangent to the curve and is equal to the rate of change of speed along the point. The normal component is perpendicular to the tangent and is equal to the square of the tangential speed divided by the *radius of curvature* at the point.



$$A = A_x + A_y$$

acceleration–time curve (E.M.)

A curve showing the variation of acceleration with time is called an acceleration-time curve. The area under the curve represents the change in velocity during the time interval. Thus:



$$a = \frac{\vartheta v}{\vartheta t}$$

$$\int_1^2 \vartheta v = \int_1^2 a \vartheta t$$

accelerator (P.P.)

The foot pedal in a motor vehicle which controls its power and speed. The accelerator is linked to a butterfly valve in the carburetor which controls the amount of fuel entering an engine.

accelerometer

An accelerometer is an instrument for measuring the acceleration of a system to which it is attached. The field of accelerometry is becoming increasingly important and there are many different designs for special applications.

accumulator (P.P.)

A pressure vessel containing water and steam, which is used to store the heat of steam for use at a later period and at some lower pressure.

accuracy in measurement (automatic controls)

The degree of correctness with which a measuring means yields the "true" value of a measured quantity. The "true" value refers to accepted engineering standards, such as the standard meter, gram, etc. It is assumed that a "true" value always exists even though it may be impossible to determine.

Acetylene (C_2H_2)

A colorless gas which burns when ignited in air. It is made by the reaction of calcium carbide and water. Acetylene is used with oxygen as a source of high temperature for welding and cutting.

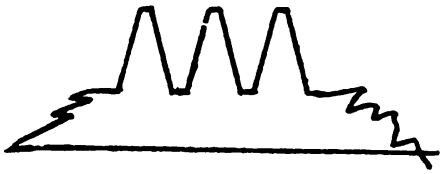
acid cleaning (P.P.)

The process of cleaning the interior surfaces of steam generating units by filling the unit with a dilute acid accompanied by an inhibitor to prevent corrosion, and subsequently draining, washing and neutralizing the acid by a further wash of alkaline water.

acid sludge (F.&C.)
Oil refinery waste fuel from acid treatment of unrefined petroleum.

acidity (F.&C.)
Represents the amount of free carbon dioxide, mineral acids and salts (especially sulphates of iron and aluminum) which hydrolize to give hydrogen ions in water and is reported as milliequivalents per liter of acid, or p.p.m. acidity as calcium carbonate, or pH the measure of hydrogen ions concentration.

acme thread
A screw thread used extensively for feed screws. The cross-section is a mean between a square and vee thread.



acoustics
Having to do with the transmission of sound.

across the grain (arch.)
Perpendicular to the run of the wood grain.

actinometer
An instrument for measuring the heating and chemical effects of light.

action (E.M.)
A concept in advanced dynamics expressing the product of twice the mean total kinetic energy of a particle during a time interval. It is defined mathematically by

$$A = 2 \int_{t_0} (ke)\, \delta t \qquad \text{(Action Integral)}$$

The English unit is foot-pound-second. The cgs system of units is erg-seconds. The action, A, is very useful in the development of dynamics from variational principles.

Maupertuis postulated a law known as the "principle of least action" which states that any unaided change which takes place in a dynamically isolated system will do so in such a manner that the action integral will have the least possible value.

actual size

A pictorial representation in true proportions.

actuating signal (automatic controls)

The difference at any time between the reference input and a signal related to the controlled variable.

acute angle

Any angle which is less than ninety degrees.

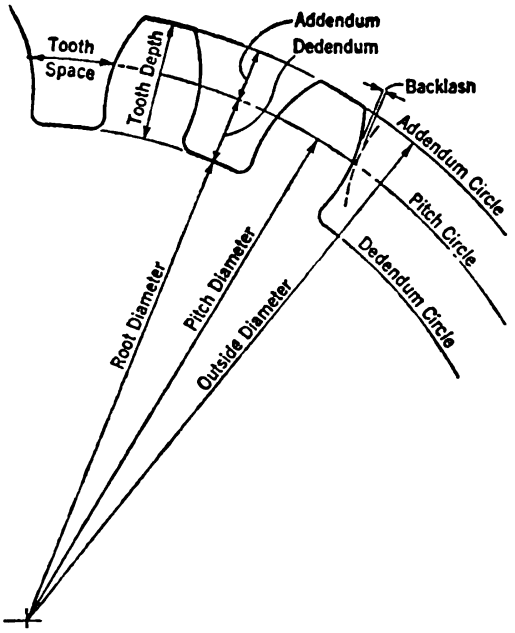
adiabatic temperature

The theoretical temperature that would be attained by the products of combustion provided the entire chemical energy of the fuel, the sensible heat content of the fuel, and combustion air above the datum temperature were transferred to the products of combustion. This assumes:

a. combustion is complete,
b. there is no heat loss,
c. there is no dissociation of gaseous compounds formed, and
d. inert gases play no part in the reaction.

addendum (E.M.)

The height of a gear tooth above pitch circle or the radial distance between the pitch circle and the top of the tooth.



addendum circle (E.M.)

The circle which passes through the outer tips of gear teeth. (See addendum)

addition

Any change whereby dimensions or quantities are increased.

adhesion

A physical phenomenon describing the action of the intermolecular forces which hold matter together. The terms adhesion and cohesion are different aspects of the same phenomenon. Adhesion refers to the intermolecular attraction of dissimilar bodies adjacent to one another. Cohesion refers to the intermolecular attraction of the particles of a body that constitute its mass.

Adhesion tends to increase with closeness of contact. This explains why the five pages of a tightly pressed book sometimes cling together, or sand blasting is necessary to clean

out the fine particles in the brickwork of a building exposed to wind and rain. This also explains why it is difficult to remove gum from a newly washed floor.

Cohesion is usually less in liquids than in solids and always least in gases. The cohesive force in matter is one which has defied direct measurement. While some measurements have been made on solids, very little has been done on liquids and gases. The evidence of the existence of this force lies in the fact that work of some form is necessary for their expansion.

adit

A horizontal passage made from the earth's surface into a mine.

admiralty metal

A bronze alloy consisting of 70% copper, 29% zinc and 1% tin.

adobe

Aluminous earth; brick made from this earth without heat; a dwelling built of these materials.

adsorption

Adsorption is the accumulation of the molecules of a substance by another substance. For example, charcoal is used industrially as a high quality adsorber. When placed in an enclosure with ordinary air, it will adsorb certain molecules leaving the air "pure" and odorless. Its industrial and military applications are in sea food freezers, gas masks, etc. If it is placed in a solution of unrefined sugar it will likewise remove some of the impurities. Activated charcoal (charcoal freed from adsorbed matter by heating) is effective probably because of its porous structure.

aeolotropic (E.M.)

Pertaining to the heterogeneous distribution of stresses in a material.

aeration (F.&C.)
The process of mixing air with pulverized fuel in a transport pipe or storage bin.
Generally, mixing with air.

age hardening
Hardening of a metal by aging, usually after rapid cooling or cold working. See aging.

agglomerating (F.&C.)
A caking characteristic of a coal that, in the volatile matter determination, causes it to give a coke residue in the form of an agglomerate button.

agglomeration (F.&C.)
Groups of fine dust clinging together to form a larger particle.

agglutinating (F.&C.)
A characteristic of coal that causes it to form a button having measurable bonded strength when mixed with certain amounts of inert material and heated in the absence or near absence of air.

aggregate (arch.)
The solid particles from which concrete is made. The classification of aggregate is either fine or coarse depending upon the specified size. Fine aggregate consists of sand or screened stone while coarse aggregate is either gravel, crushed stone or cinders. The aggregate should be strong and free from organic matter.

aging
In a metal or alloy, a change in properties that generally occurs slowly at room temperature and more rapidly at higher temperatures.

agonic
An imaginary line of the earth's surface passing through

points where the magnetic declination is 0°, that is, positions where the compass points true north.

agonic line
The line of true north.

air
The mixture of oxygen, nitrogen, and other gases, which with varying amounts of water vapor, forms the atmosphere of the earth.

air atomizing oil burner (F.&C.)
A burner for firing oil in which the oil is atomized by compressed air. The air is forced into and thru one or more streams of oil, breaking the oil into a fine spray.

air binding
The inclusion of air in a space hindering the flow of some other gas or liquid.

air blast
The flow of air at a high velocity, usually for a short period.

air brakes
A braking system used in vehicles utilizing a pressure system. A small air compressor keeps a storage tank charged at moderately high pressure. A foot pedal actuates a valve which allows high pressure air to enter one side of a diaphragm. The distortion of the diaphragm furnishes the necessary force to operate the braking system.

air-chuck
A pneumatically controlled chuck used to hold a work piece in a machining operation.

air-cleaner
A filtering device which extracts impurities from the air. It is usually used on a mechanism or machine to prevent

abrasive particles from damaging or causing excessive wear to the moving parts.

air-cooled wall (F.&C.)
A refractory wall of hollow construction through which air passes.

air deficiency (F.&C.)
Insufficient air, in an air-fuel mixture, to supply the oxygen theoretically required for complete oxidation of a fuel.

air dried
Any material that has been allowed to season in air.

air dried (F.&C.)
Condition of coal after sample has been exposed to 85° F to 95° F air until weight is constant.

air dry
Air with which no water vapor is mixed. This term is used comparatively, since in nature there is always some water vapor included in air, and such water vapor, being a gas, is dry.

air-free
The descriptive characteristic of a substance from which air has been removed.

air-fuel ratio
The ratio of the weight, or volume of air to fuel.

air gap
The air space between any two objects. The *air gap* is usually designed to serve electrical or insulation purposes.

air hardening
The use of air to control the temperature in a hardening process. Steel may be air hardened, oil hardened or water hardened. Hence, the hardening of high speed steels in a blast of air.

air heater or air preheater (P.P.)

Heat transfer apparatus through which air is passed and heated by a medium of higher temperature, such as the products of combustion or steam.

Regenerative Air Preheater—An air heater in which heat is first stored up in the structure itself by the passage of the products of combustion, and which then gives up the heat so stored to the subsequent passage of air.

air-hoist

A pneumatically operated hoist.

air infiltration

The leakage of air into a setting or duct.

air moisture

The water vapor suspended in the air.

air nozzle

An air port having direction and appreciable length for directing an air stream.

air port

An opening thru which air passes.

air-puff blower (F.&C.)

A soot blower automatically controlled to deliver intermittently jets or puffs of compressed air for removing ash, refuse, or soot from heat absorbing surfaces.

air purge

The removal of undesired matter by replacement with air.

air resistance

The opposition offered to the passage of air through any flow path.

air saturated or saturated air

Air which contains the maximum amount of water vapor that it can hold at its temperature and pressure.

air seal

A closure obtained by using air as the securing medium.

air-swept pulverizer (F.&C.)

A pulverizer through which air flows and from which pulverized fuel is removed by the stream of air.

air-transport system (F.&C.)

A fuel transport system utilizing air as the conveying medium.

air vent (P.P.)

A valve opening in the top of the highest drum of a boiler or pressure vessel for venting air.

alclad

A group of high-strength, heat-treated alloys used in aircraft construction. This *alclad group*, generally 17S, 24S or 26S, has a layer of pure aluminum on both sides which gives it a high resistance to corrosion.

alcove

Any large recess, usually separated by an arch.

algebra

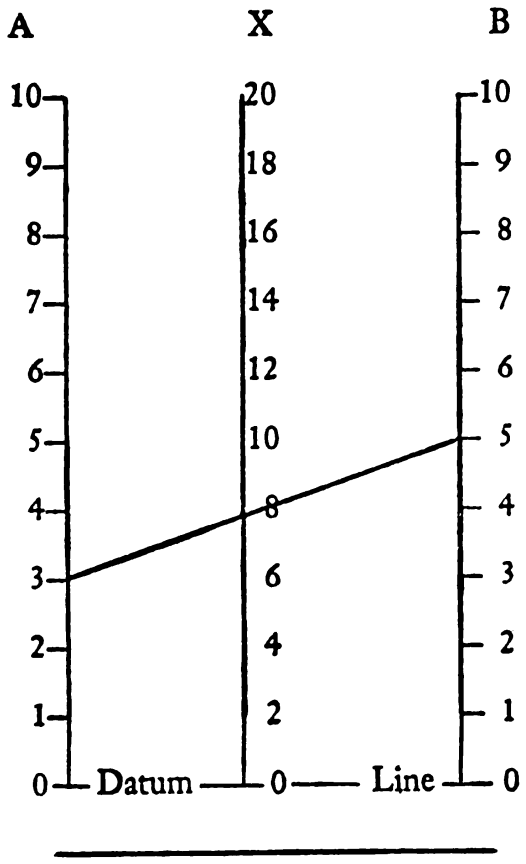
Algebra is that branch of mathematics which deals with the operation of numbers by the use of symbols. For instance, the arithmetic fact that $2 + 2 + 2 = 6$ can be generalized by the algebraic equation $x + x + x = 3x$ where x is any number; in this case two.

The history of algebra goes back to about 1700 B.C. Historic documents containing algebraic notations are the ancient papyrus of Ahmes. The early Hindus, who were great traders, developed algebra to a remarkable extent; probably because the knowledge was so necessary for trade. To the ancient Greeks however, numbers very often meant distances. Therefore, their efforts were more along the science of geometry which they developed to a remarkable degree. It wasn't until about 300 A.D that any worthwhile Greek work in algebra appeared.

alignment chart (nomography) (math.)

The science dealing with the representation of formulae containing three or more variables on charts. These charts are called nomograms. They are intended to simplify or elimnate mathematical calculations. The nomogram shown will solve the simple equation $x = A + B$. To use the diagram for addition, say $5 + 3$ on lines B and A respectively. The intersection with line x is the answer. By using an inverse method, the diagram can be used for substraction also.

The nomogram shown is a very simple one. There are some extremely complicated forms also and they are very useful in the engineering and scientific fields.



alkalinity

Represents the amount of carbonates, bicarbonates, hydroxides and silicates or phosphates in the water and is reported as grains per gallon, or p.p.m. as calcium carbonate.

all-day efficiency (P.P.)

When the use and load of a machine vary throughout the day, it becomes necessary in economy computations to figure the all-day efficiency. Since the efficiency varies from time to time during the day, the all-day efficiency is defined as the total energy output divided by the total energy input. Thus

$$e = \frac{p_1t_1 + p_2t_2 + p_3t_3 \ldots\ldots}{P_1T_1 + P_2T_2 + P_3T_3 \ldots\ldots}$$

where p and t define the various output powers and time respectively and P and T define the various input powers and time respectively.

alligator wrench

A wrench with toothed V-shaped jaws fixed in position.

allowable stress (E.M.)

The loading conditions for a material or structural member so selected to allow a proper margin of safety against damage or failure. The formula is usually written in the form

$$\text{Allowable Stress} = \frac{\text{Ultimate Stress}}{\text{Factor of Safety}}$$

The factor of safety is a function of loading conditions, material, use, etc.

allowable working pressure (P.P.)

The maximum pressure for which a boiler or pressure vessel was designed and constructed.

alpha-beta brass

Brasses containing 58-60% copper, hot working. They are usually cast, hot rolled, or hot stamped.

alpha brass
Brass suitable for cold working, containing not less than 63% copper. It is used for tube making and can be wire drawn. A typical example would be *cartridge brass* (70% copper and 30% zinc).

alpha iron
The phase of iron present in iron or steel below the critical range.

alteration (arch.)
Any change or rearrangement usually made in a structure.

alternate firing
Distributing coal on portions of a boiler grate at alternate intervals. (F.&C.) The alternate firing of first one boiler, then another (P.P.)

alternator (elect.)
An alternating current generator.

ambient air
The air that surrounds equipment. The standard ambient air for performance calculations is air at 80° F, 60% relative humidity, and a barometric pressure of 29.921 in. Hg, giving a specific humidity of 0.013 lb. of water vapor per lb. of air.

ambient temperature
The temperature of air surrounding equipment.

ammeter (elect.)
The instrument for the measure of electrical current.

ampere (elect.)
Unit used to measure the rate of flow of electrical current. The units are coulombs per second.

ampere-hour (elect.)
The quantity of electricity equivalent to a current of one ampere flowing past a point in a conductor in one hour.

ampere-turn (elect.)

The magnetizing force produced by a current of one ampere flowing through a coil of one turn.

analysis (F.&C.)

Quantitative determination of the constituent parts of a fuel.

analysis, proximate (F.&C.)

Analysis of a solid fuel determining moisture, volatile matter, fixed carbon and ash expressed as percentages of the total weight of sample.

analysis, ultimate (F.&C.)

Chemical analysis of solid, liquid or gaseous fuels. In the case of coal or coke, determination of carbon, hydrogen, sulfur, nitrogen, oxygen, and ash.

analytic geometry (math.)

Analytic geometry is that branch of mathematics which deals with the study of geometric problems by algebraic methods. Since elementary geometry was invented by the ancient Greeks who had virtually no knowledge of algebra, and algebra was invented by the Hindus who had very little knowledge of geometry, analytic geometry developed historically as two separate branches of mathematics. It wasn't until the French mathematician and philosopher René Descartes combined both branches in his great work "La Géométrie" in 1637 that analytic geometry had its beginnings.

Analytic geometry deals with much more extensive subject matter than does ordinary elementary geometry. The value of it lies in the use of algebraic methods to define the geometric properties of figures.

anchor

A device used to secure one object to another.

anchor bolt

A bolt set into masonry for the purpose of securing equipment.

anchorage

Any means of support, natural or improvised.

angle iron

A piece of iron or metal in the shape of a right angle.

angle of repose

The maximum angle which the inclined surface of a pile of loosely divided material can make with the horizontal.

angular acceleration

Angular acceleration is the ratio of the change in angular velocity of a body to the elapsed time. It is expressed mathematically by

$$\alpha = \frac{dw}{dt}$$

The common unit is radians per second per second.

Constant acceleration:

The most common use of acceleration is in equations involving motion with constant or average acceleration, i.e., uniformly accelerated motion. These are the so-called steady-state equations, as opposed to transients which are used for variable acceleration.

Curvilinear acceleration:

See angular acceleration.

Rectilinear acceleration:

Acceleration in a straight line is called rectilinear acceleration.

angular velocity

Angular velocity is the ratio of the angular displacement to the elapsed time.

anneal

To heat a metal to a high temperature and to cool so as to

soften and make less brittle. A metal is annealed so as to make it easier for machine working.

annealing

A process involving heating and cooling of a metal applied usually to induce softening. The term is also used to cover treatments intended to remove stresses; alter mechanical or physical properties; produce a definite microstructure; remove gases. Certain specific heat treatments of iron-base alloys covered by the term annealing are black annealing, blue annealing, box annealing; bright annealing, full annealing, graphitizing, malleablizing, process annealing.

annealing, black

A process of box annealing iron-base alloy sheets after hot rolling, shearing and pickling. The process does not impart a black color to the product if properly done. The name originated in the appearance of the hot-rolled material before pickling and annealing.

annealing, blue

A process of softening iron-base alloys in the form of hot-rolled sheet, in which the sheet is heated in the open furnace to a temperature within the transformation range and cooled in air; the formation of a bluish oxide on the surface is incidental.

annealing, box

A process of annealing which, to prevent oxidation, is carried out in a suitable closed metal container with or without packing material. The charge is usually heated slowly to a temperature below, but sometimes above or within, the transformation temperature range and cooled slowly. It is also called Close Annealing or Pot Annealing.

annealing, bright

A process of annealing which is usually carried out in a

controlled furnace atmosphere so that surface oxidation is reduced to a minimum and the surface remains relatively bright.

annealing, flame

A process in which the surface of an iron-base alloy is softened by localized heat applied by a high-temperature flame.

annealing, full

A softening process in which an iron-base alloy is heated to a temperature above the transformation range and, after being held for a proper time at this temperature, is cooled slowly to a temperature below the transformation range. The objects are ordinarily allowed to cool slowly in the furnace, although they may be removed from the furnace and cooled in some medium which assures a slow rate of cooling.

annealing, inverse

A heat treatment, analogous to Precipitating Hardening, applied to cast iron usually to increase its hardness and strength.

annual ring

In the case of wood, the growth layer put on in a single year.

anode (elect.)

The electrode in a cell (voltaic or electrolytic) that attracts the negative ions and repels the positive; the positive pole.

antenna

The aerial wires used for transmitting or receiving visual or audible communication waves.

anthracite (F.&C.)

Anthracite is "hard coal" containing usually less than 10%

volatile matter and more than 90% carbon. It burns with a smokeless flame and has a high luster. The A.S.T.M. (American Society of Testing Materials) is:
Dry fixed carbon, 92% or more and less than 98%.
Dry volatile matter, 8% or less and more than 2% on a mineral-matter free basis.

apparent elastic limit (E.M.)

When the properties of a material are such that it is difficult to determine the yield point on the stress-strain diagram, Johnson's apparent elastic limit is used. This point has arbitrarily been chosen by J. B. Johnson as the point on the stress-strain diagram at which the rate of change of strain with respect to stress is 50% greater than at the origin.

apparent stress (E.M.)

The product of unit strain and modulus of elasticity. This is a calculated stress assuming a straight line curve and may differ from the true stress because the traverse stresses are not considered.

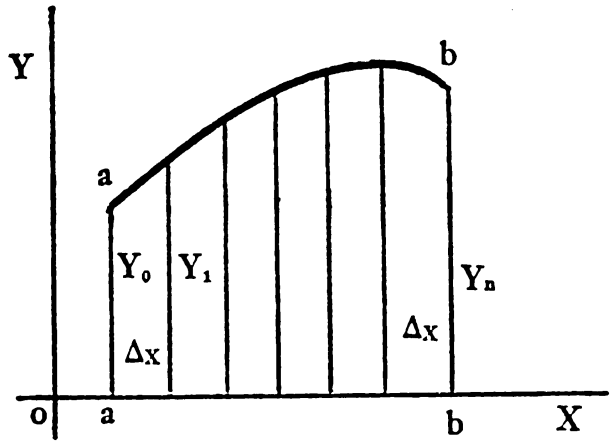
approximate integration (math.)

When the indefinite integral cannot be found, a method of approximate integration must be used. Suppose we wish to approximately evaluate the following integral:

$$\int_a^b f(x)\vartheta x$$

This can be done by either of two rules described here.
Trapezoidal rule:

Divide the area bounded by curve a-b into n equal parts and join the y-ordinates at the extremeties by chords forming trapezoids. Add the areas of the trapezoids together to get the approximate total area bounded by the curve a-b. Thus:



Area of first trapezoid $= \frac{1}{2}(Y_0 + Y_1)\Delta x$

" " second " $= \frac{1}{2}(Y_1 + Y_2)\Delta x$

" " nth " $= \frac{1}{2}(Y_{n-1} + Y_n)\,\Delta x$

Taking the sum of the foregoing we get:

$$\int_a^b f(x)\,dx \approx \frac{\Delta x}{2}(Y_0 + 2Y_1 + 2Y_2 + 2Y_3 + \ldots\ldots\ldots 2Y_{n-1} + Y_n)$$

Simpson's Rule:

Another approximation is to join the y-ordinates by arcs of parabolas instead of straight lines. This gives a closer approximation than can be gotten by the trapezoidal rule. This rule is expressed by the equation:

$$\int_a^b f(x)\,dx \approx \frac{\Delta x}{3}(Y_0 + 4Y_1 + 2Y_2 + 4Y_3 + 2Y_4 \ldots\ldots + 2Y_{n-2} + 4Y_{n-1} + Y_n)$$

For this rule the interval a-b must be divided into n parts where n is an even number.

apron (arch.)

In building, a piece of finish, plain or molded, that is put

under the inside of a window sill to cover the rough edge of plastering.

aquastat (automatic controls)
A control device used to regulate the temperature of the hot water supply in a system.

arc (elect.)
The luminous glow between incandescent electrodes.

arc of action (E.M.)
Arc of the pitch circle through which a tooth travels from the first point of contact with the mating tooth to the point of contact with the mating tooth to the point where contact ceases.

arc of approach (E.M.)
Arc of the pitch circle through which a tooth travels from the first point of contact with the mating tooth to the pitch point.

arc of recession (E.M.)
Arc of the pitch circle through which a tooth travels from the contact with the mating tooth at the pitch point to the point where its contact ceases.

arc welding
Arc welding is a non-pressure (fusion) welding process wherein the welding heat is obtained from an arc between the base metal or weld metal and an electrode or between two electrodes.

arc-welding electrode
An arc-welding electrode is a wire or metal rod or carbon (or other suitable material) rod, used as one (or both) of the terminals in an electrode circuit for the purpose of producing a welding arc.

arch
The arrangement of building materials in the form of a

curve. This arrangement preserves a given form and, when supported by piers, sustains weights and resists pressures.

arch bar (F.&C.)
A cast iron or steel bar for supporting brickwork in a furnace.

arch-furnace
A substantially horizontal structure extending into the furnace, to serve as a deflector of the gases.

arch-roof (F.&C.)
A structure composed of refractory, or combination of refractory and water tubes, enclosing the furnace or combustion chamber at the top.

architect
One who designs a building, prepares the building plans, and who also may supervise the workers who do the actual building.

architecture
The art or science of building, or designing a building, in such a way as to best enable it to fulfill its purpose and to give it the qualities of beauty, interest, harmony, and strength.

architrave (arch.)
Wooden casing or trim around a door or other square opening.

area
The total surface of an object measured in two dimensions.

areaway (arch.)
A sub-surface space left around the foundation walls to permit light or air to reach another part of the building.

armature (elect.)
The movable part of a motor or the removable part of a

magnetic circuit, such as the iron placed across the poles of a horseshoe magnet.

armored cable (elect.)
Electric wires encased in metal.

armored wall (F.&C.)
A wall of a furnace consisting of spaced tubes which are covered on the furnace side with abutting metalic blocks.

arrester (F.&C.)
A device to impede the flow of large dust particles or sparks from a stack. This may consist of screening at the top of a chimney.

arris
The edge at which two surfaces meet to form an angle, such as the corner of a board or molding.

as-fired fuel (F.&C.)
Fuel in the condition as fed to the fuel burning equipment.

as-received fuel (F.&C.)
Fuel in the condition as received at the plant.

asbestos
A fireproof, noncombustible, nonconducting, and chemically resistant mineral used for insulation.

asbestos board
A sheet of building board made of asbestos fibers and cement. It is fire-resistant and moisture-resistant and can be used for interior or exterior work.

asbestos paper
Heavy paper which will not burn and is a good insulator.

asbestos shingles
Roof or siding shingles made of Portland cement and asbestos.

ash
The incombustible inorganic matter in the fuel.

ash bed (F.&C.)
A layer of refuse left on grates or deposited on a furnace floor after the fuel is burned.

ash-free basis (F. &C.)
The method of reporting fuel analysis whereby ash is deducted and other constituents are recalculated to total 100%.

ash gate (F.&C.)
A gate or valve thru which refuse is removed from an ash pit or soot hopper.

ash pit (F.&C.)
A pit or hopper located below a furnace where refuse is accumulated and from which it is removed at intervals.

ash sluice (F.&C.)
A trench or channel used for transporting refuse from ash pits to a disposal point by means of water.

ashlar (arch.)
A type of stonework. A facing made of squared stones or of thin slabs; it is used to cover walls of brick or rubble. *Coursed* ashlar means that the stones are laid in level courses all around the building; *Random* ashlar means that the stones are of different heights but that the beds are level.

A.S.M.E.
Abbreviation for American Society of Mechanical Engineers.

A.S.M.E. dust test code
A standard procedure adopted by the A.S.M.E. which is the recognized method of determining the efficiency of dust separating equipment, particularly for boiler flue gases.

aspect ratio
A ratio used in calculating resistance to flow in a rectangular elbow and is the ratio of width to depth.

aspirating burner (F.&C.)
A burner in which the fuel in a gaseous or finely divided form is burned in suspension. The air for combustion is supplied by bringing into contact with the fuel. Air drawn thru one or more openings by the lower static pressure created by the velocity of the fuel stream.

aspirator
A device which utilizes the vacuum energy in a jet of fluid to create suction.

assembling
Fitting the fabricated parts together into complete units. Special jigs and fixtures to facilitate assembly are in many instances designed by a tool designer.

atmospheric pressure
The barometric reading of pressure exerted by the atmosphere. At sea level 14.7 lb. per sq. in. or 29.92 in. of mercury.

atomic hydrogen welding
Atomic hydrogen welding is an alternating-current arc-welding process wherein the welding heat is obtained from an arc between two suitable electrodes in an atmosphere of hydrogen.

atomizer
A device by means of which a liquid is reduced to a very fine spray.

attemperator (P.P.)
Apparatus for reducing and controlling the temperature of a superheated vapor.

attic (garret)
A low story above the upper part of a building; that part of the building that is immediately below the roof.

attrition
The reduction in size of dust particles caused by abrasion.

austempering
Quenching a ferrous alloy from a temperature above the transformation range, in a medium having a rate of heat abstraction high enough to prevent the formation of high-temperature transformation products, and then holding the alloy, until transformation is complete, at a temperature below that of pearlite formation and above that of martensite formation.

austenitizing
Forming austenite by heating a ferrous alloy into the transformation range (partial austenitizing) or above the transformation range (complete austenitizing).

auto-collimeter
A device for checking extremely small angles and the precision of mechanical parts, tools, gauges, etc.

auto-transformer (elect.)
A transformer in which the primary and secondary are connected together in one winding.

automatic control system (A.C.)
Any operable arrangement of one or more automatic controllers connected in closed loops with one or more processes.

automatic controller (A.C.)
A device which measures the value of a variable quantity or condition and operates to correct or limit deviation of this measured value from a selected reference. The automatic controller includes both the measuring means and the controlling means. True automatic control systems always contain one

or more feedback loops at least one of which includes both the automatic controller and the process.

automatic lighter (F.&C.)

A means for starting ignition of fuel without manual intervention. Usually applied to liquid, gaseous or pulverized fuel.

automatic welding

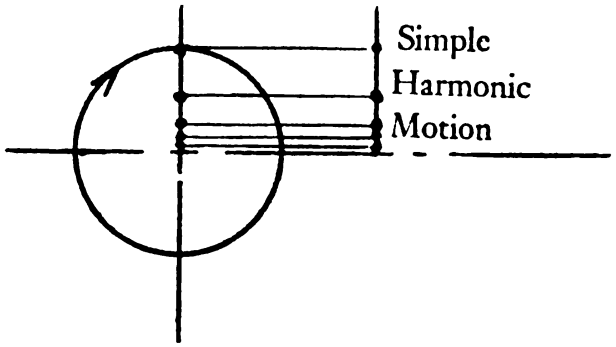
Automatic welding is welding with equipment which automatically controls the entire welding operation, including feed, speed, oscillation, interruption, etc.

auxiliary air (F.&C.)

Additional air, either hot or cold, which may be introduced into the exhauster inlet or burner lines to increase the primary air at the burners.

auxiliary circle (E.M.)

A graphical representation of simple harmonic motion is usually depicted by the projection of a point moving with constant speed around a circular path. This circular path is called the auxiliary circle.



Auxiliary Circle

availability factor

The fraction of the time during which the unit is in operable condition.

available draft (F.&C.)

The draft which may be utilized to cause the flow of air for combustion or the flow of products of combustion.

average-position action (A.C.)

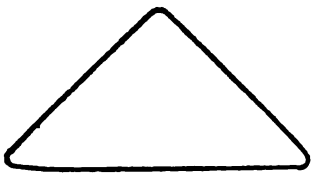
Is that in which there is a predetermined relation between the value of the controlled variable and the time-average position of a final control element which is moved periodically from one of two fixed positions to the other. This controller action is similar to two-position action in which the percentage "time-on" of the final control is dependent upon the value of the controlled variable. The percentage "time-on" may have either a fixed or infinite number of values to correspond to any one of the other positioning-controller actions.

avoirdupois

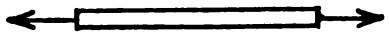
The name given to the English system of weights and measures which have the grain and the pound as units.

axial (adj.) (E.M.)

Used to describe the action of an object around, in the direction of, or along an axis. For instance, an axial force is the force along the axis of a member. In trusses, it is assumed that the members act as axially loaded bars. Hence the direction of the member is always known.



Truss



Axial Force

axial fan

Consists of a propeller or disc type of wheel within a cylinder discharging the air parallel to the axis of the wheel.

axis (pl. axes)

A line, real or imaginary, in any conical body about which all parts of a body are centrally located. When motion is present, it is that line about which the body rotates.

B

babbitting
The process of lining bearings with babbitt's or white metal.

babbitt's metal
An alloy used for lining bearings. It usually consists of 48 parts of tin, 2 parts of copper, and 4 parts of antimony.

back pressure
Pressure in any compressible flow system greater than atmospheric pressure.

back putty (arch.)
A thin sealing layer of putty placed between the glass and the rabbet of a window.

backfill (arch.)
To replace earth in a pit, trench, or other excavation from which it was removed.

backflow
The flow of water into a water-supply system for any source other than its regular source.

backing of a rafter or rib (arch.)
An upper or outer surface that is added to any rafter or rib in order to make it extend as far as the rafters or ribs on either side.

backing of a wall (arch.)
The rough inner surface of a wall; earth that is deposited behind a retaining wall, etc.

backing of a window (arch.)
That piece of wainscoting that is between the bottom of the sash frame and the door.

backing ring
A ring of steel or other material placed behind the welding groove when joining tubes or pipes by welding, to confine the weld metal.

backlash (engineering, mechanics)
The play between mating teeth of engaged gears or the shortest distance between the non-driving surfaces of adjacent teeth.

backsaw
A fine-toothed saw with a thin blade and reinforced with a steel back. Used for chamfering or mitering. Also called a *tenon* saw.

back vent pipe
That part of a vent which connects directly with an individual trap underneath a fixture and extends to the branch or main, soil, or waste pipe at any point higher than the fixture or fixture trap it serves. This is sometimes called an "individual vent."

baffle (F.&C.)
A plate or wall for deflecting gases or liquids.

baffle-type collector (P.P.)
A device in gas paths utilizing baffles so arranged as to deflect dust particles out of the gas stream.

bag (F.&C.)
A deep bulge in the bottom of the shell of a fire-tube boiler.

bag filter (P.P.)
A device containing one or more cloth bags for recover-

ing particles from the dust laden gas or air which is blown thru it.

bag-type collector (P.P.)
A filter wherein the cloth filtering medium is made in the form of cylindrical bags.

bagasse (F.&C.)
Sugar cane from which the juice has been essentially extracted.

balanced draft (P.P.)
The maintenance of a fixed value of draft in a furnace at all combustion rates by control of incoming air and outgoing products of combustion.

balcony (arch.)
A projection from the face of a wall, supported by columns or consoles, usually surrounded by a balustrade.

ball cock (P.P.)
A faucet opened or closed by the fall or rise of a ball floating on the surface of water.

ball joint (engineering, mechanics)
A connection in which a ball is held in a cuplike shell that allows movement in every direction.

ballistic pendulum (E.M.)
A device used to measure the velocity of a bullet by using the principle of the conservation of momentum.

balloon framing (arch.)
A system of framing wooden buildings in which the corner posts and studs are continuous in one piece from sill to roof plate. The intermediate joists are carried by girts spiked to, or let into, the studs; the pieces are secured only by nailing, without the use of mortises, tenons, and the like. This system is used in modern building where relatively light lumber is used.

baluster (arch.)
An ornamental upright post giving support to a rail.

balustrade (arch.)
A row of balusters capped by a rail.

band brake or prony brake (P.P.)
A device used on any rotating member to restrict motion of that member by friction.

banking (F.&C.)
Burning solid fuels on a grate at rates sufficient to maintain ignition only.

banking (live) F.&C.)
Operating boilers at combustion rates just sufficient to maintain normal operating pressure under conditions of no load demand.

bare tube superheater (P.P.)
A superheater in which all of the heating surface consists of the external surface of the tubes.

bare-tube wall (P.P.)
A furnace wall having bare tubes.

barge board (arch.)
The board under the edge of gables also called a *verge* board.

bark (F.&C.)
The fibrous external covering of trees. Bark from wood pulp mills and spent tan bark are major sources of bark as fuel.

barley (F.&C.)
Anthracite coal size—through 3/16" round mesh screen, over 3/32" round mesh screen; otherwise known as No. 3 Buckwheat.

barometric pressure

Atmospheric pressure as determined by a barometer; usually expressed in inches of mercury.

barrier valve (P.P.)

A strong valve, not necessarily dust-tight, used as protection against furnace explosions traveling back into pulverizers or exhausters opened for inspection or maintenance.

base circle (E.M.)

The circle from which an involute tooth curve is generated or developed.

base load (P.P.)

Base load is the term applied to that portion of a station or boiler load that is practically constant for long periods.

base (parent) metal (welding)

Base metal is the metal which is to be welded (or cut).

base moldings (arch.)

The moldings immediately above the bottom of a wall, pillar, or pedestal.

base plate (arch.)

The horizontal member on a foundation upon which the wall partitions are secured.

baseboard (arch.)

The molding covering the joint between the floor and a wall. It is also called a skirting.

basement (arch.)

The lower part of a building, usually not more than one-half below the level of the lot or street.

bat (arch.)

Usually signifying a length of insulation.

batten door (arch.)
A door made of sheathing secured by strips of board, placed crossways, and nailed with clinched nails.

battens (arch.)
Small strips of board placed over the joints of sheathing in order to keep out the weather.

batter (arch.)
A wall, or a piece of timber or other material, that does not stand upright but leans away from you when you stand in front of it. When it leans toward you, it is called an overhand.

batter boards (arch.)
Horizontal boards set in pairs a short distance back from each corner of an excavation. The boards are each nailed to two upright stakes, and are used to indicate the building level, and as a support for various guide lines that are stretched between them.

battery (elect.)
A group of several cells connected together as a unit.

battery setting (P.P.)
Describes a setting of two or more boilers with common division walls.

bay (arch.)
Any division or compartment of an area.

bay window (arch.)
Any window that projects outward from the wall of a building.

bead (arch.)
A circular wooden molding.

bead (weld.)
The joining of two metal surfaces with one or more passes of welding metal.

beaded tube-end (P.P.)
The rounded exposed end of a rolled tube in a boiler when the tube metal is formed over against the sheet in which the tube is rolled.

beading (arch.)
Small wooden molding usually used for decorative purposes.

beam (arch.)
A heavy timber or other material placed horizontally, and on end, over an opening to support a load.

bearing (adj.) (arch.)
That portion of a structure that supports a load such as a bearing, wall or a bearing partition.

bearing partition (arch.)
A partition which supports any load besides its own weight.

bearing wall (arch.)
A wall which supports an additional part of a building above it.

becket
A device for holding something in place; a loop or ring at the end of a block.

bed (arch.)
A specially prepared surface, usually of mortar, sand, or cinders, on which the bricks or stones of walls are to be laid.

bed moisture (F.&C.)
The moisture in coal when in the seam.

bed of a slate (arch.)
The under side of a slate surface.

bee hive coke (F.&C.)
Coke manufactured in bee hive, rectangular, or similar forms of ovens in a horizontal bed where heat for the coking process is secured by combustion within the oven chamber.

belay (arch.)
To secure the running end of a rope around a cleat, spar, or its own standing end.

bell or hub (P.P.)
That portion of a pipe which, for a short distance, is sufficiently enlarged to receive the end of another pipe of the same diameter for the purpose of making a joint.

belled tube-end (P.P.)
See *Flared Tube-End.*

bellows seal
A seal in the shape of a bellows used to prevent air or gas leakage.

belly
To bulge out.

belt (arch.)
A course of stones or brick projecting from a brick or stone wall, generally in a line with the window sills. It may be molded, fluted, planed, or ornamented.

belt friction (E.M.)
The resistance to motion offered to a transmission belt by the driven body.

bending moment (E.M.)
The product of the perpendicular component of a force on a structural member and the distance from a reference

point. It is customary to assign a positive algebraic sign to clockwise moments and a negative sign to counterclockwise moment.

bending pin (or iron) (P.P.)
A tool used for straightening or expanding lead pipe.

benzine (C_6H_6)
First member of the *aromatic* hydrocarbon series. May be synthesized by heating acetylene in a closed vessel at moderately low temperatures. In practice it is obtained as a by-product in the production of coke. Used as a solvent and its main components are *octane* and nonane.

bevel
(1) Instrument used to adjust surfaces of work to any given angle.
(2) To cut on a slant, so the angle formed is not a right angle. One side of a solid body is said to be beveled with respect to another when the angle contained between the two sides is either greater or less than a right angle.

bevel siding (arch.)
Siding made by "resawing" dry, square-surfaced boards diagonally to produce two wedge-shaped pieces. It is used as the finish siding on the exterior of a house.

bibb (P.P.)
A faucet with the nozzle threaded so that a hose can be attached. Syn. Faucet, cock, tap, plug.

bidet
A plumbing fixture used for washing the middle part of the body, especially the genitals.

bight (arch.)
A loop formed on rope so that the two portions cross each other.

bin system (F.&C.)

A system in which fuel is pulverized, stored in bins, and subsequently withdrawn thru feeders to the burners in amounts sufficient to satisfy load demands.

bird-nesting (F.&C.)

Accumulations of porous masses of loosely adhering refuse and slag particles in the first tube bank in a watertube boiler.

bitransit waste (P.P.)

A standing overflow.

bituminous coal (F.&C.)

ASMT Coal classification by rank on a mineral matter free basis and with bed moisture only:

Low Volatile: Dry fixed carbon 78% or more and less than 86% and dry volatile matter 22% or less and more than 14%.

Medium Volatile: Dry fixed carbon 69% or more and less than 78%; and dry volatile matter 31% or less and more than 22%.

High Volatile: (A) Dry fixed carbon less than 69%; and dry volatile matter more than 31%—Moist Btu 14,000 or more. (B) Moist Btu 13,000 or more and less than 14,000. (C) Moist Btu 11,000 or more and less than 13,000 (either agglomerating or non-weathering).

black annealing

Box annealing or pot annealing ferrous alloy sheet, strip, or wire. See box annealing.

black liquor (F.&C.)

Liquid by-product fuel extracted from resinous woods in a wood pulp manufacturing process and containing in the chemicals used to accomplish the extraction.

blank carburizing

Simulating the carburizing operation without introducing carbon. This is usually accomplished by using an inert material in place of the carburizing agent, or by applying a suitable protective coating to the ferrous alloy.

blank flange (P.P.)

A flange that is not drilled.

blank head (P.P.)

A head, without a manhole, at the end of a boiler drum.

blank nitriding

Simulating the nitriding operation without introducing nitrogen. This is usually accomplished by using an inert material in place of the nitriding agent, or by applying a suitable protective coating to the ferrous alloy.

blanking

Stamping or cutting out regular or irregular flat shapes with a die out of sheet steel by means of a press exerting great pressure.

blast furnace gas (F.&C.)

Lean combustible by-product gas resulting from burning coke with a deficiency of air in a blast furnace.

bleed (arch.)

Wood is said to bleed when the liquid contained in it works its way to the surface.

blemish (arch.)

In the case of wood, anything, not necessarily a defect, marring its appearance.

blind flange

A flange that closes the end of a pipe. There is no opening for the passage of fluid.

blind nipple
A nipple, or a short piece of pipe or tube, closed at one end.

blister
A raised area on the surface of a solid produced by pressure while the solid is hot and plastic due to heating.

block (arch.)
A grooved pulley in a frame or shell provided with a hook, eye, or strap by which it may be attached.

block tin
Pure tin.

blocking or blocking-course (arch.)
A course of stones placed on top of a cornice crowning the walls.

blow tank (F.&C.)
A device for transporting pulverized material, consisting of a tank containing a batch of pulverized material, into which compressed air is admitted to form an aerated mixture which flows through a pipe to the desired bin.

blowback (P.P.)
The difference between the pressure at which a safety valve opens and at which it closes, usually about 3 per cent of the pressure at which valve opens.

blowdown (P.P.)
Removal of a portion of boiler water for the purpose of reducing concentration, or to discharge sludge.

blower
A fan used to force air under pressure.

blowhole (F.&C.)
A local area in a burning fuel bed through which a disproportionately large quantity of air passes.

blowoff (P.P.)

A controlled outlet on a pipe line used to relieve pressure inside a system.

blowtorch action (F.&C.)

Impingement of a localized jet of hot gas on a surface.

blue annealing

Heating hot-rolled ferrous sheet in an open furnace to a temperature within the transformation range and then cooling in air, in order to soften the metal. The formation of a bluish oxide on the surface is incidental.

blueprint

A photographic print showing white lines against the blue background, commonly used to reproduce architect's drawings.

bluing

Subjecting the scale-free surface of a ferrous alloy to the action of air, steam, or other agents at a suitable temperature, thus forming a thin blue film of oxide and improving the appearance and resistance to corrosion.

board foot (arch.)

A unit for the measurement of lumber. It refers to a piece of lumber measuring one foot square on the surface and one inch in thickness or to its equivalent (144 sq. in.).

boiler

A closed pressure vessel in which a liquid, usually water, is vaporized by the application of heat.

Water Tube—A boiler in which the tubes contain water and steam, the heat being applied to the outside surface.

Bent Tube—A water tube boiler consisting of two or more drums connected by tubes, practically all of which are bent near the ends to permit attachment to the drum shell on radial lines.

Horizontal—A water tube boiler in which the main bank

of tubes are straight and on a slope of 5 to 15 degrees from the horizontal.

Sectional Header—A horizontal boiler of the longitudinal or cross-drum type, with the tube bank comprised of multiple parallel sections, each section made up of a front and rear header connected by one or more vertical rows of generating tubes and with the sections or groups of sections having a common steam drum.

Box Header—A horizontal boiler of the longitudinal or cross drum type consisting of a front and a rear inclined rectangular header connected by tubes.

Cross Drum—A sectional header or box header boiler in which the axis of the horizontal drum is at right angles to the center lines of the tubes in the main bank.

Longitudinal Drum—A sectional header or box header boiler in which the axis of the horizontal drum or drums is parallel to the tubes in a vertical plane.

Low-Head—A bent tube boiler having three drums with relatively short tubes in the rear bank.

Fire Tube—A boiler with straight tubes, which are surrounded by water and steam and through which the products of combustion pass.

Horizontal Return Tubular—A fire-tube boiler consisting of a cylindrical shell, with tubes inside the shell attached to both end closures. The products of combustion pass under the bottom half of the shell and return through the tubes.

Locomotive—A horizontal fire-tube boiler with an internal furnace the rear of which is a tube sheet directly attached to a shell containing tubes through which the products of combustion leave the furnace.

Horizontal Fire-Box—A fire-tube boiler with an internal furnace the rear of which is a tube sheet directly attached to a shell containing tubes. The first-pass bank of tubes is connected between the furnace tube sheet and the rear head. The second-pass bank of tubes, passing over the crown sheet, is connected between the front and rear end closures.

Refractory Lined Fire-Box—A horizontal fire-tube boiler, the front portion of which sets over a refractory or water-cooled refractory furnace, the rear of the boiler shell having an integral or separately connected section containing the first-pass tubes through which the products of combustion leave the furnace, then returning through the second-pass upper bank of tubes.

Vertical—A fire-tube boiler consisting of a cylindrical shell, with tubes connected between the top head and the tube sheet which forms the top of the internal furnace. The products of combustion pass from the furnace directly through the vertical tubes.

Submerged Vertical is the same as the plain type above, except that by use of a water leg construction as a part of the upper tube sheet, it is possible to carry the water-line at a point above the top ends of the tubes.

Scotch—In stationary service, a fire tube boiler consisting of a cylindrical shell, with one or more cylindrical internal furnaces in the lower portion and a bank of tubes attached to both end closures. The fuel is burned in the furnace, the products of combustion leaving the rear to return through the tubes to an uptake at the front head—known as Dry-back type.

In marine service, this boiler has an internal combustion chamber of water leg construction covering the rear end of the furnace and tubes, in which the products of combustion turn and enter the tubes—known as Wet-back type.

boiler convection bank

A group of two or more rows of tubes forming part of a water tube boiler circulatory system and to which heat is transmitted mainly by convection from the products of combustion.

boiler horsepower

The evaporation of 34½ lbs. of water per hour from a

temperature of 212° F into dry saturated steam at the same temperature. Equivalent to 33,472 Btu.

boiler slag screen

A screen formed by one or more rows of widely spaced tubes constituting part of, or positioned in front of, a water tube boiler convection bank, and functioning to lower the temperature of the products of combustion and to serve as an ash cooling zone.

boiler water

A term construed to mean a representative sample of the circulating boiler water, after the generated steam has been separated and before the incoming feed water or added chemical becomes mixed with it so that its composition is affected.

boiling

The conversion of a liquid into vapor with the formation of bubbles.

boiling out

The boiling of a highly alkaline water in boiler pressure parts for the removal of oils, greases, etc.

bond (arch.)

A retaining or holding high-temperature cement for making a joint between brick or adjacent courses of brick.

bond-stones (arch.)

Stones running through the thickness of the wall at right angles to its face, in order to bind it together.

bond-timbers (arch.)

Timbers placed horizontally in tiers in the walls of a brick building, and to which the battens, and laths, are secured. In rubble work, walls are better plugged for this purpose.

bonding tile (arch.)
Tile designed to provide recesses for header brick in brick-faced walls.

bone coal
Coal from that part of a seam which has a very high ash content. In connection with anthracite, any material which has 40% or more, but less than 75% fixed carbon.

bonnet (P.P.)
That portion of a gate valve into which the disk rises when the valve is opened.

book tile (arch.)
Tile with tongue and groove edges resembling a book in shape.

booster fan
A device for increasing the pressure or flow of a compressible fluid.

border (arch.)
A series of ornamental pieces which are placed around the edge of a construction.

boring
Enlarging a hole to an exact diameter by means of an adjustable cutting tool with one cutting edge. This method insures the making of concentric holes.

boss
A raised portion of metal of small area and limited thickness on flat or curved metal surfaces.

bossing stick (arch.)
A wooden tool for shaping lead for tank lining.

bottom air admission (F.&C.)
A method of introducing air to a chain or traveling grate stoker from under the stoker.

bottom diameter (E.M.)

The diameter of a circle tangent to the seating curve at the bottom of the tooth gap of a roller chain sprocket. Equal to the pitch diameter minus the chain roller diameter.

boundary conditions (E.M.)

As used in solid mechanics the term refers to the condition of displacement, stress, or slope at the limits of a member where these properties are deduced from the data of the problem, thus a stressed beam with fixed ends will deform with zero slope at the limits of the beam. The zero slope is a boundary condition.

Bow's notation (E.M.)

In graphical methods for finding the resultant of a force system, a special method for identifying the forces is known as Bow's notation.

box annealing

Annealing a metal or alloy in a sealed container under conditions that minimize oxidation. In box annealing a ferrous alloy, the charge is usually heated slowly to a temperature below the transformation range, but sometimes above or within it, and is then cooled slowly; this process is also called "close annealing" or "pot annealing." See black annealing.

box sill (arch.)

A foundation sill in which the sole plate rests on the floor joists.

box union (P.P.)

A device for joining two threaded pipes.

brace (arch.)

An inclined piece of timber. Braces are used in trussed partitions or in a frame roof to form a triangle and thereby stiffen the framing.

bracing (arch.)

A system of framing a building in which all vertical struc-

tural elements of the bearing walls and partitions, except the corner posts, extend for only one story. They start at the foundation sill for the upper-story framing and at the top plate of the story below for all stories above the first. Corner posts extend from foundation sill to roof plate and are braced by diagonal members usually extending the full height of each story and crossing several of the studs in each outer wall.

bracket (arch.)
A projecting ornament carrying a cornice.

brad
A small nail.

branch (P.P.)
A branch is any part of a piping system other than a main.

branch circuit (elect.)
One of the conductors in a parallel circuit.

branch interval (P.P.)
A length of soil or waste stack corresponding in general to a story height, but in no case less than 8 ft., within which the horizontal branches from one floor or story of a building are connected to the stack.

branch vent (P.P.)
A vent pipe connecting from a branch of the drainage system to a vent stack.

break (arch.)
Any projection from the surface of a building.

breaking joints (arch.)
Arranging bricks or stones so that the joints are staggered and no one joint is allowed to fall directly over another.

breast of a window (arch.)
The masonry forming the back of the recess and the parapet under the window sill.

breeching (P.P.)
A duct for the transport of the products of combustion between parts of a steam generating unit to the stack.

breezeway (arch.)
A passageway between two buildings that has a roof but is open on both sides.

brick course (arch.)
A layer of bricks.

brick veneer (arch.)
A thin layer of bricks often used as a finish.

bridgewall (F.&C.)
A wall in a furnace over which the products of combustion pass.

bridging (F.&C.)
The accumulation of refuse and slag partially or completely blocking spaces or apertures between heat absorbing tubes.

bridging (arch.)
A method of stiffening floor joists and by placing small wooden braces between them in a diagonal position.

bright annealing
Annealing in a protective medium to prevent discoloration of the bright surface.

British thermal unit (BTU)
The mean British Thermal Unit is 1/180 of the heat required to raise the temperature of 1 lb. of water from 32° F to 212° F at a constant atmospheric pressure. It is about equal to the quantity of heat required to raise 1 lb. of water 1° F. A Btu is essentially 252 calories. See B.T.U.

broaching
Forming or cutting regular or irregular shaped holes or

notches within metal parts with a long serrated tool which is pulled or pushed through the piece.

broken coal
Anthracite coal size—through 4⅜", over 3½" round mesh screen.

brown coal
Lignitic coal lowest in classification according to rank. Moist (bed moisture only) Btu less than 8300, unconsolidated in structure.

brown coat (arch.)
The second coat of plaster or stucco.

brush (elect.)
The conducting material, usually a block of carbon, bearing against the commutator or slip-rings through which the current flows in or out.

B.T.U.
Abbreviation for British thermal unit.

bubble (P.P.)
A small volume of steam inclosed within a surface film of water from which it was generated.

buckle (arch.)
To heave up; as a buckled floor.

buckstay (F.&C.)
A structural member placed against a furnace or boiler wall to restrain the motion of the wall.

buckstay spacer (F.&C.)
A spacer for separating a pair of channels which are used as a buckstay (q.v.) in a boiler.

buckwheat (F.&C.)
Anthracite coal size:

No. 1 (Buckwheat)—through 0/16", over 5/16" round mesh screen.

No. 2 (Rice)—through 5/16", over 3/16" round mesh screen.

No. 3 (Barley)—through 3/16", over 3/32" round mesh screen.

No. 4—through 3/32", over 3/64" round mesh screen.

No. 5—through 3/64" round mesh screen.

bug dust (F.&C.)

Bituminous coal dust screenings of a fineness below commercial size.

building codes (arch.)

Local laws or ordinances regulating the various phases of construction work.

building drain (arch.)

Same as "house drain."

building line (arch.)

A line of demarcation between property. A line beyond which a building or part thereof cannot extend without permission.

building sewer

Same as "house sewer."

building subdrain

That portion of a drainage system which cannot drain by gravity into the building sewer.

bulge (F.&C.)

A local distortion or swelling outward caused by internal pressure on a tube wall or boiler shell caused by overheating. Also applied to similar distortion of a cylindrical furnace due to external pressure when overheated provided the distortion is of a degree that can be driven back.

bulk modulus of elasticity (E.M.)

The ratio of the increase in pressure or unit stress to the corresponding decrease in volume.

$$K = -\frac{P}{\Delta V/v}$$

where P = pressure & V = volume

bull-headed tee (P.P.)

A tee in which the branch is larger than the run.

bump (P.P.)

A raised or flattened portion of a boiler drum head or shell formed by fabrication, generally used for nozzle or pipe attachments.

bunker C oil (F.&C.)

Residual fuel oil of high viscosity commonly used in marine and stationary steam power plants. (No. 6 fuel oil).

burner (P.P.)

A device for the introduction of fuel and air into a furnace at the desired velocities, turbulence and concentration to establish and maintain proper ignition and combustion of the fuel.

burner windbox (P.P.)

A plenum chamber around a burner in which an air pressure is maintained to insure proper distribution and discharge of secondary air.

burner windbox pressure (P.P.)

The air pressure maintained in the windbox or plenum chamber measured above atmospheric pressure.

burning

Permanently damaging a metal or alloy by heating to cause either incipient melting or intergranular oxidation. See overheating.

burr
Roughness or extra metal protruding from the walls of a pipe, usually as a result of cutting the pipe.

bushing (arch.) (P.P.)
A plug designed to be threaded into the end of a pipe. The plug is bored and tapped to receive a pipe of smaller diameter than that of the pipe into which the bushing is screwed.

butt
To join end to end. As a butt joint. (q.v.)

butt-joint
The method by which two pieces of material are joined together, without overlapping.

butter (arch.)
In masonry, to apply mortar to a brick.

buttstrap (P.P.)
A narrow strip of boiler plate overlapping the joint of two butted plates, used for connecting by riveting.

BX cable (elect.)
Electric wires in a flexible metal covering.

by-pass
Any method by which a flowing substance may pass around a valve, fixture, appliance, connection, or length of pipe.

by-pass temperature control
Control of vapor or air temperature by diverting part or all of the heating medium from passing over the heat absorbing surfaces, usually by means of a by-pass damper.

by-product coke (F.&C.)
Coke manufactured with attendant recovery of by-products in ovens that are heated externally.

C

caking (F.&C.)
Property of certain coals to become plastic when heated and form large masses of coke.

calcium chloride
A chemical that is used to absorb moisture from air.

calculating action (A.C.)
The coupling of primary feedbacks with one another and/or any other actuating signal(s) to follow any computable function of the combination. Typical cases are ratio action, multiplication action.

caliber (E.M.)
Internal diameter or bore.

caliper diameter (E.M.)
The distance measured across the bottoms of two opposite tooth gaps on a roller chain sprocket having an even number of teeth, and measured between one tooth gap and the nearest opposite gap for a sprocket with an odd number of teeth.

calking (arch.)
Plugging an opening with oakum, lead, or other materials and pounded it into place. Also, the material that is pounded into the opening.

calking recess (arch.)
A counterbore or recess in the back of a flange into which lead may be calked for water, or copper for steam.

calorie
The mean calorie is 1/100 of the heat required to raise the temperature of 1 gram of water from 0° C to 100° C at

a constant atmospheric pressure. It is about equal to the quantity of heat required to raise one gram of water 1° C. A more recent definition is: A calorie is 3600/860 joules, a joule being the amount of heat produced by a watt in one second.

calorific value

The number of heat units liberated per unity of quantity of a fuel burned in a calorimeter under prescribed conditions.

calorimeter

Apparatus for determining the calorific value of a fuel.

camber (arch.)

The convexity of a beam upon the surface in order to prevent its becoming concave by its own weight or by the load it may have to support.

cantilever

A structural member which is supported at only one end and which supports a projecting load.

cap (P.P.)

A fitting which is screwed on to the end of a pipe for the purpose of closing the end.

cap (arch.)

The cement finish used on top of a brick wall or chimney.

capacitance (A.C.)

The change in quantity contained per unit of change in a reference variable. It is measured in units of quantity, divided by the reference variable. The energy or material being contained and the reference variable determine the type of capacitance. Process capacitance may involve different quantities and reference variables, and several types may exist together in one process.

The volume capacitance of an open tank with respect to head is the change of volume of stored liquid per unit change

of head, which is equivalent in value to the area of the liquid surface. It should be noted that if the shape of the tank causes the liquid surface area to vary with change of head, the capacitance will likewise vary with head.

The weight capacitance of a gas-filled tank with respect to pressure is the change of weight of stored gas per unit change of pressure.

capacity (A.C.)

Is a measure of the maximum quantity of energy or material which can be stored within the confines of a stated piece of equipment. It is measured in units of quantity. The volume capacity of an open tank, for example, is the maximum volume of liquid it will hold without overflowing. The weight capacity of a compressed air tank is the maximum weight of air it will hold without exceeding safe pressure.

capacity factor

The ratio of the average load carried to the maximum design capacity.

carbon (F.&C.)

Element. The principal combustible constituent of all fuels.

carbon arc cutting (weld.)

Carbon arc cutting is the process of severing metals by melting with the heat of a carbon arc.

carbon-arc electrode (weld.)

A carbon-arc electrode is a carbon or graphite rod through which current is conducted between the electrode holder and the arc.

carbon arc welding (weld.)

Carbon arc welding is an arc-welding process wherein one or more carbon or graphite electrodes are used with or without the use of filler metal.

carbon loss

The loss representing the unliberated thermal energy occasioned by failure to oxidize some of the carbon in the fuel.

carbonitriding (heat treat)

Introducing carbon and nitrogen into a solid ferrous alloy by holding above the austenite temperature in an atmosphere that contains suitable gases such as hydrocarbons, carbon monoxide, and ammonia. The carbonitrided alloy is usually quench hardened.

carbonization

The process of converting coal to carbon by removing other ingredients.

carburizing (heat treat)

Introducing carbon into a solid ferrous alloy by holding above the austenite temperature in contact with a suitable carbonaceous material. The carburized alloy is usually quench hardened.

carriage (arch.)

The joist that supports the steps of a wooden stair.

carryover (P.P.)

The chemical solids and liquid entrained with the steam from a boiler.

case (heat treat)

In a ferrous alloy, the outer portion that has been made harder than the inner portion or core by case hardening.

case (arch.)

A covering.

case hardening

Hardening a ferrous alloy so that the outer portion or case is made substantially harder than the inner portion or core. Typical processes used for case hardening are carbur-

izing, cyaniding, carbonitriding, nitriding, induction hardening, and flame hardening.

casement (arch.)
A frame housing a window, that is made to open by turning on hinges attached to its edges.

casement windows
Windows with the sash hinged to open like a door.

casing (arch.)
Wooden trim around doors and windows.

casing (P.P.)
A covering of sheets of metal or other material such as fire resistant composition board used to enclose all or a portion of a steam generating unit.

cast-iron pipes
Soil pipes usually made of cast iron and used for sewage systems.

catch basin (arch.)
A receptacle in which liquids are retained for a sufficient period to deposit settleable material.

cathode (elect.)
The electrode in a cell (voltaic or primary) that attracts the positive ions and repels the negative ions; the negative pole.

caulk or calk (arch.)
To fill a crack or seam around an opening with oakum.

caulking compound
A soft plastic used for caulking. It sets soft, and can be painted.

ceiling (arch.)
That part of a room which covers the joists of the floor above.

ceiling joists
Lumber used to support the ceiling.

cellar (arch.)
With a basement, the cellar is that portion of the building below the basement. With no basement, it is the portion, more than one-half of which is below the level of the street.

cells (arch.)
Hollow spaces enclosed within the perimeter of the exterior shells and having a minimum dimension of not less than ½″ and a cross-sectional area of not less than 1 sq. in.

cement
An adhesive used to bind objects together. There is also Portland cement, which is used in concrete.

cement plaster (arch.)
A mixture of Portland cement and sand, used as a finish coat.

cementation (heat treat)
The introduction of one or more elements into the outer portion of a metal object by means of diffusion at high temperature.

center distance (E.M.)
The distance between the centers of the shafts of a chain drive.

center of gravity (E.M.)
That point about which a body will be balanced regardless of its position. It is the center of parallel forces which act upon the body. For a symmetrical figure, the c.g. corresponds to its geometric center.

It is also the point where we can consider the mass to be concentrated without altering the effect of gravity upon that body. See "center of mass."

center of mass (E.M.)

Center of mass is that point on a body which when struck by a force will cause the body to move with pure translation. The center of mass coincides with the center of gravity providing the force of gravity has the same magniture and direction at all points on the body. This is true in any practical case of interest. It should be noted that different concepts are involved in the definitions of the two centers.

center of moments (E.M.)

The intersection of the axis of moments with the plane of forces is called the center of moments.

center of oscillation or center of percussion (E.M.)

The point at which the resultant of applied forces intersects the normal axis.

center of shear (E.M.)

See torsional center.

center of suspension (E.M.)

That point from which a compound pendulum is suspended.

center of torsion (E.M.)

See torsional center.

center of twist (E.M.)

See torsional center.

central axis (E.M.)

The axis that passes through the centroid of an area. The axis is understood to lie in the plane of the area. When the axis is normal to the plane of the area, it is the *central polar axis.*

central polar axis (E.M.)
See central axis.

central station (P.P.)
A power plant or steam heating plant generating power or steam for sale.

centrifugal fan
Consists of a fan rotor or wheel within a scroll type of housing discharging the air at right angle to the axis of the wheel.

centrifugal force (E.M.)
That force exerted along the radius of a rotating body and directed outward from its axis of rotation. The force equal in magnitude but oppositely directed is called the centripetal force.

centrifuge
A mechanical device used for rotating an object at high angular velocities.

centripetal force (E.M.)
That force exerted along the radius of a rotating body and directed inward from the axis of rotation. Centrifugal and centripetal forces are equal in magnitude but oppositely directed.

centroid (E.M.)
That point which corresponds to the center of gravity of a geometric figure of infinitesimal thickness.

centroid of an area (E.M.)
That point in the plane of an area about which the unbalanced moment is zero, for an infinitely thin, homogeneous area the centroid of the area corresponds with the center of gravity of the area.

centroidal axis (E.M.)
See central axis.

centroidal rotation (E.M.)
When the axis of a rotating body passes through the center of gravity, it is said to have centroidal rotation.

cesspool (arch.)
A pit for the reception or detention of sewage.

chafing fatigue
Fatigue caused by surface rubbing of contact surfaces.

chain
A series of links, flexibly connected in a continuous succession.

chain casing
An oil retaining sheet metal enclosure, around a chain drive.

chain grate stoker (P.P.)
A stoker which has a moving endless chain as a grate surface, onto which coal is fed directly from a hopper.

chain guard
An open guard of sheet metal, expanded metal, or similar construction around a chain drive.

chain pitch
For a roller chain, the distance in inches between the centers of adjacent joint members. For a silent chain, the distance in inches between the centers of the holes in a link plate.

chain take-up
An idler sprocket, or similar device, mounted on an adjustable bracket to adjust the slack in a chain drive.

chain tongs (P.P.)
A tool used for holding pipe from turning or for turning

the pipe. It consists of a heavy bar with sharp teeth at one end. These teeth are held firmly impressed in the pipe by means of a chain wrapped around the pipe and attached to the bar.

chain width

For a roller chain, the distance between the link plates of a roller link. This is *not* the over-all width of the chain. For a silent chain, the width over the working link plates of the chain, exclusive of pin heads, washers, or other fastening devices.

chamfer (arch.)

A bevel, or a groove, or a channel into timber, masonry, or metal. Also, the surface formed when the angle made by adjacent faces of a piece of timber, masonry, or metal, is cut away.

chase (arch.)

A recess in a wall for the purpose of holding pipes and conduits passing from floor to floor.

check (arch.)

In the case of wood, a separation along the grain, the greater part of which occurs across the rings of annual growth.

checker work (F.&C.)

An arrangement of alternately spaced brick in a furnace with openings through which air or gas flows.

check valve (P.P.)

A valve that automatically closes to prevent the flow of water in a reverse direction.

chemical analysis

Determination of the principal chemical constituents.

chemical feed pipe (P.P.)
A pipe inside a boiler drum through which chemicals for treating the boiler water are introduced.

chimney
A brick, metal or concrete stack.

chimney core
The inner cylindrical section of a double wall chimney, which is separated from the outer section by an air space.

chimney lining
The material which forms the inner surface of the chimney.

chipping knife
A knife used for whittling or cutting lead.

chock (arch.)
To round-in blocks of tackle until they touch each other.

choke coil (elect.)
A coil of low ohmic resistance and comparatively high impedance to alternating current.

chordal addendum (E.M.)
The radial distance from a line representing the chordal thickness at the pitch circle to the top of the tooth.

chordal effect (chordal action) (E.M.)
The effect produced by a chain's joint center being forced to follow arcs instead of chords of the sprocket pitch circle.

chordal pitch (E.M.)
The length of one side of a polygon formed by the lines between the joint centers as a chain is wrapped on a sprocket. It is a chord of the sprocket pitch circle, and is equal to the chain pitch.

chordal thickness (E.M.)
Length of the chord subtended by the circular thickness

(the dimension obtained when a gear-tooth caliper is used to measure the thickness at the pitch circle).

cinder (P.P.)
Particles of partially burned fuel from which volatile gases have been driven off, which are carried from the furnace by the products of combustion. The size is usually larger than 100 microns in diameter.

cinder-catcher (P.P.)
Apparatus for separating and collecting cinders from the products of combustion.

cinder-return (P.P.)
Apparatus for the return of collected cinders to the furnace, either directly or with the fuel.

cinder trap (P.P.)
A dust collector having staggered elements in the gas passage which concentrates larger dust particles. A portion of the gas passes thru the elements with the concentrated dust into a settling chamber, where change in direction and velocity drops out coarser particles.

cinders (P.P.)
Ashes from coal used as fill or mixed with cement to produce cinder blocks.

circuit (elect.)
The complete path of an electric current, including, usually, the generating device.

circuit breaker (elect.)
A device that opens a circuit while it is carrying current; often used in abnormal conditions, such as overloads.

circuit vent (arch.)
A group vent extending from in front of the last fixture connection on a horizontal branch to the vent stack. See also "loop vent."

circular burner (F.&C.)
A liquid, gaseous or pulverized fuel burner having a circular opening thru the furnace wall.

circular frequency (E.M.)
The number of oscillations per second made by the diametrical projection of a point moving in a circle at a constant angular speed is called the circular frequency. The path usually described is simple harmonic motion.

circular mil
An area equal to that of a circle with a diameter of 0.001 inch. It is used for measuring the cross section of wires.

circular motion
Motion where all parts of a moving body are at some constant distance from the axis of rotation.

circular pitch (E.M.)
Length of the arc of the pitch circle between the centers or other corresponding points of adjacent teeth.

circulation (P.P.)
The movement of water and steam within a steam generating unit.

circulation ratio (P.P.)
The ratio of the water entering a circuit to the steam generated within that circuit in a unit of time.

circulator (P.P.)
A pipe or tube to pass steam or water between upper boiler drums usually located where the heat absorption is low. Also used to apply to tubes connecting headers of horizontal water tube boilers with drums.

clapboard (arch.)
Board having one edge thicker than the other. It is usually used for exterior siding of houses.

class (F.&C.)
Rank of coal.

classification (F.&C.)
Method of separating coals with reference to their properties. See "Grade" and "Rank."

classifier (F.&C.)
The part of a pulverizer system which rejects coarse particles from the air stream conveying pulverized fuel.

cleanout door (P.P.)
A door placed so that accumulated refuse may be removed from a boiler setting.

clearance (E.M.)
Radial distance between the top of a tooth and the bottom of the mating tooth space.

clinch (arch.)
To bend over. As to "clinch" a nail.

clinch nail (arch.)
A nail made of soft steel, which bends over easily at the end.

clinker (F.&C.)
A hard compact congealed mass of fused furnace refuse, usually slag.

clinker chill (F.&C.)
Any water cooled wall surface, the major portion of which is in contact with the edges of the fuel bed.

clinker grinder stoker (P.P.)
One in which the refuse is discharged into a pit containing, at the bottom, one or more grinding rolls within which are continuously or intermittently operated to produce a positive discharge of refuse to the ash pit.

clinkering (F.&C.)
The formation of clinkers.

clockwise
The term applied to movement in the direction of the hands of a clock.

close nipple (arch.)
A pipe fitting with outside threads only, used for connecting two pipes. The length of the threads and of the fitting are the shortest permissible for standard practice.

close return bend (arch.)
A short cast or malleable U-shaped pipe fitting, with arms joined together.

close string or box string (arch.)
A method of finishing the outer edge of stairs by building up a sort of curb string on which the balusters set. The treads and risers stop against it.

closed fireroom system (P.P.)
A forced draft system in which combustion air is supplied by elevating the air pressure in the fireroom.

closed force polygon (E.M.)
When the tip-to-tail addition of the free vectors comprising a force system close, they form a closed force polygon.

closet bolt (arch.)
A bolt used for fastening a water-closet bowl to the floor.

closet screw (arch.)
A long screw with a detachable head; used for fastening a water-closet to the floor.

cloth collector (F.&C.)
Cloth filter.

coal
Solid hydro-carbon fuel formed by ancient decomposition of woody substance under conditions of heat and pressure.

coal burner (P.P.)
An industrial burner for use with pulverized coal.

coal gas
Gas formed by the destructive distillation of coal.

coal tar
Black viscous liquid, one of the by-products formed by distillation of coal.

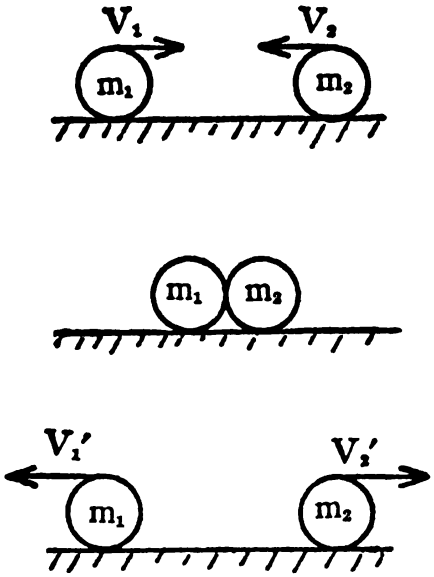
coarse aggregate (arch.)
Crushed stone, gravel, blast furnace slag, or other approved inert materials of similar characteristics, or combinations thereof having hard, strong, durable pieces, from adherent coatings. See aggregate.

coat (arch.)
A thickness or covering of paint, plaster or other material applied at one time. The first coat of plaster is called the scratch coat; the second coat (when there are three coats) is called the brown coat; and the last coat is called the white coat.

cock
See "faucet."

coefficient of restitution (E.M.)
Is a measure of the resilience of two colliding bodies. If the kinetic energy of the two bodies remains the same, we say that the collision is perfectly elastic. We measure the degree that a pair of colliding bodies approach 100% of elasticity by a dimensionless quantity called the *coefficient of*

restitution. For direct central impact it is defined as "the negative ratio of the relative velocity after collision to the relative velocity before collision." Thus:



$$\text{Coefficient of restitution} = -\frac{V_1' - V_2'}{V_1 - V_2}$$

coffer (arch.)
A deep panel in a ceiling.

cohesion
See adhesion.

coke (F.&C.)
Fuel consisting largely of the fixed carbon and ash in coal obtained by the destructive distillation of bituminous coal.

coke breeze (F.&C.)
Fine coke screenings usually passing a ½" or ¾" screen opening.

coke oven gas (F.&C.)
Gas produced by destructive distillation of bituminous coal in closed chambers. Heating value 500-550 Btu/cu. ft.

coke oven tar
See coal tar.

coking (F.&C.)
The conversion by heating in the absence or near absence of air, of a carbonaceous fuel, particularly certain bituminous coals, to a coherent, firm, cellular carbon product known as coke.

coking plate (F.&C.)
A plate adjacent to a grate, thru which no air passes and on which coal is placed for distilling the coal volatiles before the coal is moved onto the grate.

cold treatment
Cooling to a low temperature for the purpose of obtaining desired conditions or properties, such as dimensional or structural stability.

collapse (arch.)
In the case of wood, a caving at a surface of a piece. It sometimes occurs in streaks, giving the surface a corrugated appearance and often is due to the flattening of the cells when wet wood is dried quickly.

collar (arch.)
A sleeve in back of a flange.

collar beam (arch.)
A piece of lumber running horizontally between two rafters to provide additional support. It is placed above the lower ends of the rafters and nailed to them. Also called rafter tie.

collection efficiency (P.P.)
The ratio of the weight of dust collected to the total weight of dust entering the collector.

collector (P.P.)
A device used for removing as borne solids from flue gas.

colloid (P.P.)
A finely divided organic substance which tends to inhibit the formation of dense scale and results in the deposition of sludge, or causes it to remain in suspension, so that it may be blown from the boiler.

colloidal fuel (F.&C.)
Mixture of fuel oil and powdered solid fuel.

column (E.M.)
An upright compression member the length of which exceeds three times its least lateral dimension.

column capital (E.M.)
An enlargement of the end of a reinforced concrete column and flat slab.

column strip (E.M.)
A portion of a flat slab panel one-half panel in width consisting of the two adjacent quarter-panels on either side of the column center lines and extending through the panel in the direction of the span considered for bending.

combination automatic controller (A.C.)
Is more than one closed loop connected in combination, the loops being coupled through primary feedback or any of the controller elements.

This distinction should be carefully made between a plurality of independent automatic controllers with no coupling except for secondary feedback disturbances and a

combination automatic controller with definite coupling between two or more loops.

combination column (E.M.)
A column in which a structural steel member, designed to carry the principal part of the load, is wrapped with wire and encased in concrete of such quality that some additional load may be allowed thereon.

combination fixture (arch.)
A plumbing fixture including a sink and a washtray combined in one fixture.

combustible (F.&C.)
The heat producing constituents of a fuel.

combustible in refuse (F.&C.)
Combustible matter in the solid refuse resulting from the incomplete combustion of fuel. It may occur in the flue dust discharged from the stack or collected in hoppers, as well as in ash-pit refuse.

combustible loss (F.&C.)
The loss representing the unliberated thermal energy occasioned by failure to oxidize completely some of the combustible matter in the fuel.

combustion
The rapid chemical combination of oxygen with the combustible elements of a fuel resulting the production of heat.

combustion chamber
See Furnace.

combustion rate (F.&C.)
The quantity of fuel fired per unit of time, as pounds of coal per hour, or cubic feet of gas per minute.

common (arch.)
A line, angle, surface, etc., that is shared by more than one

object. Common centering is a centering without trusses, having a tie beam at the bottom. Common joists are the beams in naked flooring to which the joists are attached. Common rafters in a roof are those to which the laths are attached.

common boards (arch.)
Boards one inch thick and up to twelve inches wide. Also a grade of lumber.

common bricks
Ordinary red bricks of standard size.

common vent (arch.)
Same as "unit vent" and "dual vent."

commutator (elect.)
That part of the armature of a dynamo which converts an alternating into a direct current.

companion flange (arch.)
A flange drilled according to a standard that will fit the standard drilled holes in a flanged pipe or fitting.

compartment (F.&C.)
One of two or more air chambers under the stoker from which air can be passed in controlled quantities.

compass saw
A saw with narrow, tapering blade. Used to cut curves, circles, and fine cuts.

complete combustion
The complete oxidation of all the combustible constituents of a fuel.

component (E.M.)
One of a set of forces or vectors. See vector; components of a vector.

composite bodies—composite figures (E.M.)
A configuration of geometric shapes.

composite column (E.M.)
A column in which a steel or cast-iron structural member is completely encased in concrete containing spiral and longitudinal reinforcement.

composition wood (arch.)
Flexible building material made by pressing wood fibers into thin sheets of building board.

compound pendulum (E.M.)
A rigid body which is free to rotate about a horizontal axis, and oscillates under the influence of gravity is called a compound pendulum.

compression (E.M.)
Compression is the state of being shortened. When a force tends to shorten a body, we say that it is in compression.

compression faucet or valve (arch.)
A faucet or valve in which the flow of water is shut off by means of a flat disk that is screwed down onto its seat.

concentration (P.P.)
(1) The weight of solids contained in a unit weight of boiler or feed water. (2) The number of times that the dissolved solids have increased from the original amount in the feedwater to that in the boiler due to evaporation in generating steam.

concrete
A mixture of Portland cement, sand, gravel, and water.

concrete paint
A mixture composed of cement, water, and coloring matter, for use on concrete and cement surfaces. Any paint formulated for use on concrete or cement.

concurrent
Acting at a point (See force).

condensate (P.P.)
Condensed water resulting from the removal of latent heat from steam.

condenser (elect.)
A device consisting of two or more conductors separated by non-conductor material; it holds or stores an electric charge.

condenser (P.P.)
A device used to change a vapor to a liquid usually by cooling.

conductance (elect.)
The reciprocal of electrical resistance. Conducting power.

conductivity
The ease with which a substance transmits electrical or heat energy.

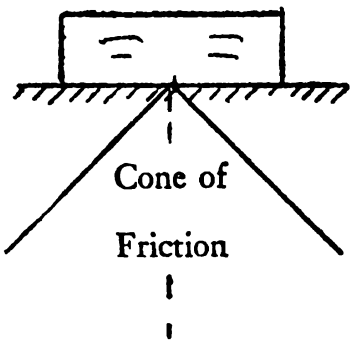
conductor
A material capable of transmitting electrical or heat energy.

conductor, leader, or downspout (arch.)
A vertical pipe to convey rain water.

conduit
A channel, canal, or pipe for the conveyance of water or the protection of electric wires.

cone of friction (E.M.)
The cone generated by revolving the angle of friction about the normal. The generated cone is called the cone of

friction. For the system to remain in static equilibrium, the static reaction of the force system must lie within the cone.



conical pendulum (E.M.)

When the swinging arm of a pendulum generates a cone, the pendulum is called a conical pendulum.

connecting link (E.M.)

For a roller chain, a pin link made with one link plate easily detachable to facilitate connecting or disconnecting the two ends of a chain.

conservation of momentum (E.M.)

The mass of a system multiplied by the velocity of the system is equal to its momentum. This value remains constant for any system and can be written as:

$$M_1V_1 + M_2V_2 = M_1V_1' + M_2V_2'$$

The above equation is for a system composed of two particles m_1 and m_2.

contact ratio (E.M.)

Ratio of the arc of action to the circular pitch.

continuous blowdown (P.P.)

The uninterrupted removal of concentrated boiler water

from a boiler to control total solids concentration in the remaining water.

continuous tube element (P.P.)

An integral heat absorbing assembly consisting of one tube, or a series of tubes welded together, without the use of intermediate flanges or headers.

continuous vent and continuous waste-and-vent (arch.)

A continuation of, and in a straight line with, the drain to which a vent connects. A continuous waste-and-vent is further defined by the angle that the drain and vent at the point of connection make with the horizontal; for example, vertical continuous waste-and-vent, 45° continuous waste-and-vent, and flat (small-angle) continuous waste-and-vent.

continuous waste (arch.)

A waste from two or more fixtures connected to a single trap.

control agent (A.C.)

Is that process energy or material of which the manipulated variable is a condition or characteristic.

control point (A.C.)

Is the value of controlled variable which, under any fixed set of conditions, the automatic controller operates to maintain. In some types of automatic controllers, for example those with two-position differential gap or floating with neutral controller action, the control point becomes a control range of values of the controlled variable rather than a single value. In positioning-type controller action, the control point may lie anywhere within a predetermined range of values of the controlled variable. The control point may then differ from the set point by the amount of offset. In floating controller action with zero neutral zone, the control point and the set point coincide.

control valve
A valve used to control the flow of a fluid.

controlled cooling
Cooling from an elevated temperature in a predetermined manner, to avoid hardening, cracking, or internal damage, or to produce a desired microstructure. This cooling usually follows a hot-forming operation.

controlled medium (A.C.)
Is that process energy or material in which a variable is controlled.

controlled multicyclone (P.P.)
A dust collector consisting of a number of cyclones thru which the volume and velocity of gas can be regulated by means of dampers in order to maintain dust collector efficiency at low loads.

controlled variable (A.C.)
That quantity or condition which is measured and controlled.

controlling means (A.C.)
Consists of those elements of an automatic controller which are involved in producing a corrective action.

convection-type superheater
See Superheater.

conversion of units
See Index.

converter, rotary (elect.)
An electrical machine having a commutator at one end and slip-rings at the other end of the armature. It is used for the conversion of alternating to direct current.

coping (arch.)
The capping or covering of a wall. It is made of stone and weathered to throw off moisture.

coping saw
A saw with an extremely narrow blade which can be turned in the frame to saw at various angles.

coplaner
Acting in the same plane. (See Force).

copper bit
A tool used for soldering. Usually called a "soldering iron."

corbel (arch.)
A short piece of stone or wood projecting from a wall to form a support, generally ornamented.

corbel out (arch.)
To build one or more courses of brick or stone out from the face of a wall in order to form a support for timbers.

cordage
The general term applied to all vegetable fiber yarn or ropes.

core (metals)
In a ferrous alloy, the inner portion that is softer than the outer portion or case.

core (elect.)
A mass of iron placed inside a coil to increase its magnetism.

corner beads (arch.)
Thin metal beads having rounded corners. They are used to protect plaster at corners and to guide the plasterer.

corner block (arch.)
A masonry block having one square end.

corner firing (F.&C.)
A method of firing liquid, gaseous or pulverized fuel in which the burners are located in the corners of the furnace.

cornice (arch.)

The projection at the top of a wall finished by a blocking-course. Usually, the portion of a wall directly under the eaves.

corporation cock (arch.)

A stop valve placed in a service pipe close to its connection with a water main; sometimes placed in the parking between curb and sidewalk.

correction (A.C.)

The valve required to correct an indicated error. Thus: True Value – Indicated Value = Correction.

corrective action (A.C.)

The variation of the manipulated variable produced by the controlling means.

corrosion

The wasting away of metals due to chemical action. In a boiler, usually caused by the presence of O_2, CO_2 or an acid.

corrosion fatigue

Fatigue of a repeatedly stressed body by corrosion. The stress peels off the corrosion exposing the metal to more corrosion resulting ultimately in failure.

corrosion resisting chromium and chromium-nickel steel (stainless) welding electrodes

All ferrous electrodes containing chromium in excess of 4 per cent as a principal alloying element and with or without the addition of nickel.

coulomb (elect.)

The unit of static electricity; the quantity of electricity transferred by one ampere in one second.

counter EMF (elect.)

Counter electromotive force; an EMF in a coil or armature that opposes the applied voltage.

counter diagonals (E.M.)

In trusses supporting moving loads such as a railroad bridge, it is possible for the diagonal members to undergo a reversal of stresses, tension and compression. If the diagonal tends to buckle, it is necessary to support the panel with a *counter diagonal* sloping in the opposite direction to prevent the truss from collapsing.

counter flashing (arch.)

Flashing applied over flashing.

counterclockwise

Opposite to clockwise.

countersink

To make a cavity for the reception of a plate of iron, or the head of a screw or bolt, so that it will not project beyond the face of the work.

couple (E.M.)

A system of equal, opposite, and parallel forces which are in equilibrium and tend to produce rotation.

coupled control element combination (A.C.)

Is one in which two or more feedback or actuating signals or control element actions are combined to operate one controlling means.

coupled feedback element combination (A.C.)

Is one in which the primary feedback to an automatic controller is a function of the primary feedback actuating signal or control output from one or more other automatic controllers as well as from its own measuring means.

coupled reference input or cascade combination (A.C.)

Is one in which the control output, or the actuating feedback signal from one automatic controller is used to regulate or readjust the set-point or modify the reference input signal of one or more other automatic controllers.

coupling (arch.)
A pipe fitting with inside threads only, used for connecting two pieces of pipe.

coupling
In plumbing, a device used to join sections of pipe or hose.

coupling (A.C.)
Is that connecting means through which signals or actions directly related to two or more closed loop automatic controllers are combined to achieve a control function beyond the capabilities of independent automatic controllers. Couplings may occur as (a) feedback coupling (b) reference input coupling (c) control element coupling.

course (arch.)
A layer of bricks or stones in buildings; applied to slates, shingles, etc.

cove ceiling (arch.)
A ceiling springing from the walls with a curve.

coved and flat ceiling (arch.)
A ceiling in which the section is the quadrant of a circle, rising from the walls and intersecting in a flat surface.

cowl (arch.)
A hood on the top of a vent pipe or soil stack.

cracked residue (F.&C.)
The fuel residue obtained by cracking crude oils.

cracking (F.&C.)
The thread decomposition of complex hydrocarbons into simpler compounds or elements.

cradling (arch.)
Timber work for sustaining the lath and plaster of vaulted ceilings.

creep (E.M.)

The continual increase in strain while the stress remains constant—usually occurring in metals under tension at high temperatures, when creep occurs at atmospheric temperatures, it is called drift or elastic drift.

The deformation of a material while under a constant compressive stress is called plastic flow.

creosote (arch.)

Wood or coal tar used as a wood preservative.

cricket (arch.)

A small, sloped roof structure which is placed where two larger surfaces meet at an angle. Its function is to divert drainage.

cricket (P.P.)

A wedge-shaped member refractory or other construction used to subdivide a channel into hopper-shaped pockets.

critical range or critical temperature range (weld.)

Synonymous with transformation range, which is preferred.

critical speed (E.M.)

When the rotative speed of a machine is equal to the impressed frequency, the condition is known as resonance. At resonance conditions, the machine has reached its critical speed.

cross (arch.)

A pipe fitting used for connecting four pipes at right angles.

cross break (arch.)

A separation of the wood cells across the grain.

Note: Such breaks may be due to internal strains resulting from unequal shrinkage or to external forces.

cross bridging (arch.)
Strips of wood nailed between the cloor joists to form an "X".

cross connection (arch.)
Any physical connection or arrangement of pipes between two otherwise separate building water-supply pipes or systems through which or by means of which water may flow from one system to the other, the direction of flow depending on the pressure differential between the two systems. Sometimes called an "interconnection."

cross-grained wood (arch.)
Wood in which the fibers are not parallel with the axis of a piece.

cross-over fitting (arch.)
A small pipe fitting like a double offset or the letter U, with ends turned out. Available only in small sizes and used to pass one pipe over another when they meet in the same plane.

cross-tube burner (P.P.)
A form of burner so arranged with respect to furnace wall tubes that the length of the burner opening is at right angles to the line of the tubes.

crossover (arch.)
A connection between two parallel pipes in the same water-supply system.

crown (P.P.)
The crown of a trap. This is the part of a trap in which the direction of flow is changed from upward to downward.

crown (arch.)
The top part of an arch, or of an arched surface.

crown vent (P.P.)
A vent pipe connected at the crown of a trap.

crown weir (P.P.)
The highest part of the inside portion of the bottom surface at the crown of a trap.

crowning (arch.)
To raise the center of a flat surface so that water will drain off.

crotch height (E.M.)
For a silent chain, the height of the link crotch above the pitch line of the link.

crude oil
Unrefined petroleum.

crusher (F.&C.)
A machine to reduce lumps of solid fuel to a desired maximum size.

culm (F.&C.)
The fine refuse from anthracite production.

cup joint
A lead pipe joint in which one end of the pipe is opened enough to receive the tapered end of the adjacent pipe.

curb box
A device consisting usually of a long piece of pipe or tube-like casing, placed over a curb cock, through which a key is inserted to permit the turning of the curb cock. Sometimes called a "Buffalo box."

curb cock
A valve placed in a service pipe at a point near the curb.

curb roof or mansard roof (arch.)
A roof formed of four contiguous planes, each pair having an external inclination.

curly-grained wood

Wood in which the fibers are distorted so that they afford a curled appearance, as in "bird's eye" wood.

Note: Areas showing curly grain may vary up to several inches in diameter.

current of electricity

The continuous flow of electrons in a circuit.

curtain wall

See Wall, Curtain.

cyaniding (heat treat)

Introducing carbon and nitrogen into a solid ferrous alloy by holding above the temperature at which austenite begins to form in contact with molten cyanide of suitable composition. The cyanided alloy is usually quench hardened.

cycling (A.C.)

A periodic change of the controlled variable. (syn. oscillation).

cyclone (P.P.)

A device which uses centrifugal action for separation of materials of different densities.

cyclone air lock (F.&C.)

A device at the bottom of a cyclone which permits the pulverized fuel to discharge but prevents the back flow of air.

cyclone capacity (P.P.)

The volume of gas passing through a cyclone with a given pressure drop or resistance, at a given gas density.

cyclone cone (P.P.)

The tapered portion at the bottom of a cyclone.

cyclone efficiency (P.P.)

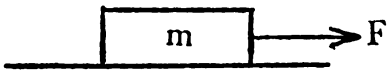
See Collection Efficiency.

D

dado (arch.)
A rectangular, flat-bottomed groove cut in wood.

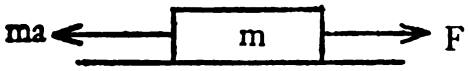
dado joint (arch.)
A joint made by cutting a tongue on the end of one member to fit into a dado cut in the other member.

D'Alembert's principle (E.M.)
The principle first observed by D'Alembert that an accelerating body can be placed in dynamic equilibrium by an "inertial force" equal in magnitude but oppositely directed to the Newtonian product ma. The Newtonian and D'Alembert points of view are illustrated in the figures



$F = ma$

Newtonian Viewpoint



$F - ma = O$

D'Alembert's Viewpoint

Hence, a principle by which a system in dynamic equilibrium can be reduced to a system in static equilibrium.

damaging stress (E.M.)

The point at which the stress in a material will cause a structural member to be unfit for service.

damper (P.P.)

A device for introducing a variable resistance for regulating the volumetric flow of gas or air.

(a) *Butterfly Type*—a single blade damper pivoted about its center.

(b) *Curtain Type*—A damper, composed of flexible material, moving in a vertical plane as it is rolled.

(c) *Flap Type*—A damper consisting of one or more blades each pivoted about one edge.

damper control (P.P.)

See by-pass temperature control.

damper loss (P.P.)

The reduction in the static pressure of a gas flowing across a damper.

damping capacity (E.M.)

The energy dissipated to heat per unit volume of material during a cycle of unit stress.

darby (arch.)

A flat tool used by plasterers, especially when working on ceilings. It is usually above seven inches wide and forty-two inches long, having two handles on the back.

D'Arsonval galvanometer (elect.)

A galvanometer in which a moving coil swings between the poles of a permanent horseshoe magnet.

de-slag (P.P.)

To remove slag which has adhered to heat absorbing surfaces.

dead band (A.C.)
The range of values through which the input can be varied without initiating output response.

dead end (P.P.)
The extended portion of a pipe that is closed at one end to which no connections are made on the extended portion, thus permitting the stagnation of water or air therein.

dead-end tube (P.P.)
A tube with a closed end—for example, a tube in a porcupine boiler.

dead plate (P.P.)
A grate through which no air passes.

dead time (A.C.)
Any definite delay between two related actions. It is measured in units of time.

deaeration (P.P.)
Removal of air and gases from boiler feed water prior to its introduction to a boiler.

decarburization (heat treat)
The loss of carbon from the surface of a ferrous alloy as a result of heating in a medium that reacts with the carbon.

decay (arch.)
In the case of wood, destruction of the wood substance due to the action of wood-destroying fungi.

Note: "Doate" and "rot" are synonymous with "decay" and are any form of decay which may be evident either as a dark red discoloration not found in the sound wood, or the presence of white or red rotten spots.

decayed knot (arch.)
A knot which due to advanced decay is not as hard as the surrounding wood.

dedendum (E.M.)
Depth of tooth space below pitch circle or radial dimension between the pitch circle and the bottom of a tooth space.

deep-seal trap (P.P.)
A trap with a seal of 4 in. or more.

defect (arch.)
In the case of wood, any irregularity occurring in or on the wood that may lower its strength.

deflector (F.&C.)
A device for changing direction of a stream of air or of a mixture of pulverized fuel and air.

deformation (E.M.)
The elongation or shortening of a body when under tension or compression. Syn. strain.

deformed bar (arch.)
Reinforcing bars with closely spaced shoulders, lugs or projections formed integrally with the bar during rolling. Wire mesh with welded intersections not farther apart than twelve inches in the direction of the principal reinforcement and with cross wires not smaller than No. 10 W. & M. gage may be rated as a deformed bar.

degasification (P.P.)
Removal of gases from samples of steam taken for purity tests. Removal of CO_2 from water as in the ion exchange method of softening.

degree of superheat (P.P.)
The number of degrees between steam temperature and saturated temperature corresponding to the steam pressure.

delayed combustion (F.&C.)
A continuation of combustion beyond the furnace. (See also Secondary Combustion).

demagnetize
To deprive a body of its magnetic properties.

denatured alcohol
In painting, a liquid used to thin shellac.

density (mass density) (E.M.)
Density is defined as mass per unit volume. In engineering problems, one must be cautioned to use the units of density that are consistant with the problem. Sometimes the mass density is confused with specific weight. This confusion can be avoided if the units of density are always included in the mathematical solution. In the English system, the unit of mass is slugs per cubic foot.

derivative action (A.C.)
Is that in which there is a predetermined relation between a time derivative of the controlled variable and the position of a final control element. The most common form of derivative is the first derivative or rate action (see rate action).

design (arch.)
The plans, elevations, sections, and whatever other drawings may be necessary to exhibit the design of a building. The term PLAN has a restricted application to a technical portion of the design.

design horsepower (P.P.)
The specified horsepower for a drive multiplied by a service factor. It is the value used to select the driving connector.

design load (P.P.)
The load for which a steam generating unit is designed, usually considered the maximum load to be carried.

design pressure (P.P.)
The maximum allowable working pressure permitted under the rules of the A.S.M.E. Construction Code.

design steam temperature (P.P.)

The temperature of steam for which a superheater is designed.

desuperheater (P.P.)

Apparatus for reducing and controlling the temperature of a superheated vapor.

(a) Shell-and-Tube Type
(b) Spray Type
(c) Submerged Type

detail (arch.)

As used by architects, detail means the smaller parts into which a composition can be divided. It is generally applied to moldings and other adornments.

detail drawing (arch.)

A separate sketch made of a portion of a plan or drawing to show more clearly the construction details of that portion.

detrusion (E.M.)

Shear strain.

developed boiler horsepower (P.P.)

The boiler horsepower generated by a steam generating unit.

developed length (P.P.)

The length along the center line of the pipe and fittings.

deviation (A.C.)

The difference between the actual value of the controlled variable and the value of the controlled variable corresponding with the set point.

deviation in measurement (A.C.)

The statistical number representing the randomness among independent measurements of the same true value.

Deviation is variously expressed as:

(a) The difference between any measurement and the mean value of two or more;

(b) The average of several independent variations from the mean. Hence the *average deviation;*

(c) The root-mean-square value computed from several individual deviations; usually called the *standard deviation;*

(d) The ratio of (a), (b) or (c) to the mean.

In any case the number of observations should be stated.

dew point (P.P.)

The temperature at which water vapor condenses out of air.

diagonal-grained wood (arch.)

Wood in which the fibers are at an angle with (that is, diagonal to) the axis of a piece as a result of sawing at an angle with the axis of the tree.

Note: It may appear on either the radial or flat-grain surface.

diagonal sheathing (arch.)

Sheathing applied in diagonal, rather than horizontal or vertical lines.

diagonal stay (P.P.)

A brace used in fire-tube boilers between a flat head or tube sheet and the shell.

diameter

The line passing through a circle at its thickest part; the length of this line. The diameters of the lower and upper ends of the shaft of a column are called its INFERIOR and SUPERIOR diameters, respectively. The former is the greatest, the latter the least diameter of the shaft.

diametral pitch (E.M.)

Ratio of the number of teeth to the number of inches of pitch diameter—equals number of gear teeth to each inch of pitch diameter. (See also normal diametral pitch.)

diaphragm (P.P.)
A partition of metal or other material placed in a header, duct or pipe to separate portions thereof.

die (P.P.)
A tool for cutting pipe threads.

dielectric
A non-conducting material.

differential gap (A.C.)
When applied to two position controller action, it is the smallest range of values through which the controlled variable must pass in order to move the final control element from one to the other of its fixed positions. Differential gap is commonly expressed in units of the controlled variable or percent of the controller scale range.

differential heating (heat treat)
Heating that produces a temperature distribution within an object in such a way that, after cooling, various parts have different properties as desired.

diffuser (F.&C.)
As applied to oil or gas burners, a metal plate with openings so placed as to protect the fuel spray from high velocity air while admitting sufficient air to promote the ignition and combustion of fuel. Sometimes termed impeller.

dimension stuff (arch.)
Lumber two inches thick and up to twelve inches wide.

diode (elect.)
A vacuum tube containing the filament and the plate; it serves as a rectifier of alternating current.

dip-grained wood (arch.)
Wood which has single waves or undulations of the fibers, such as occur around knots and pitch pockets.

dip needle
A magnetized needle capable of rotation in a vertical plane.

dip of a trap (P.P.)
The lowest portion of the inside top surface of the channel through the trap.

direct cross connection (P.P.)
A continuous enclosed interconnection between two piping systems such that the flow of water from one system to the other may occur whenever a pressure differential is set up in the connection between the two systems.

direct current (elect.)
An electric current that flows in one direction only.

direct-fired boiler (P.P.)
Commonly used to denote a boiler and furnace fired by pulverized coal directly from the pulverizing mills.

direct-fired circulating system, or semi-direct fired system (F.&C.)
A form of direct firing in which the burners all branch off from a loop header and the excess fuel and air are returned to the pulverizer inlet or circulated in the header.

direct-fired system (F.&C.)
A system in which fuel is pulverized in proportion to the load demand and conveyed directly from the pulverizers to the burners.

direct quenching (heat treat)
Quenching carburized parts directly from the carburizing operation.

discharge tube (P.P.)
A tube through which steam and water are discharged into a drum. Also a riser or releaser.

disengaging surface (P.P.)
The surface of the boiler water from which steam is released.

disintegrator (P.P.)
Apparatus for freezing and breaking up, by high velocity water jets, liquid slag streams discharged from a wet bottom pulverized fuel fired furnace.

dissociation
The process by which a chemical compound breaks down into simpler constituents, as do CO_2 and H_2O at high temperature.

dissolved gases
Gases which are "in solution" in water.

dissolved solids
Those solids in water which are in solution.

distillate fuels
Liquid fuels distilled usually from crude petroleum, except residuals such as No. 5 and No. 6 fuel oil.

distillation
Vaporization of a substance with subsequent recovery of the vapor by condensation. Often used in less precise sense to refer to vaporization of volatile constituents of a fuel without subsequent condensation.

distillation zone (F.&C.)
The region in a solid fuel bed, in which volatile constituents of the fuel are vaporized.

distilled water
Water produced by vaporization and condensation with a resulting higher purity.

district (F.&C.)
Coal producing region as defined by the Federal Bituminous Coal Act of 1937.

divided furnace (P.P.)
An arrangement in which the furnace is divided into two or more parts.

division wall (F.&C.)
The wall, or walls, in a furnace to provide two or more parts. See wall, division.

domestic architecture
That branch of architecture which relates to private buildings.

domestic sewage
Same as "sanitary sewage."

door frame
The surrounding case into and out of which the door shuts and opens. It consists of two upright pieces, called jambs, and a head. The pieces are usually fixed together by mortices and tenons.

dope (arch.)
A compound used in making connections on threaded pipe.

dormer window (arch.)
A window built into the side of a roof. It, consequently, projects from the roof and has a valley gutter on each side.

double-bend fitting (P.P.)
A pipe fitting shaped like the letter S.

double-cut sprocket (E.M.)
For double-pitch roller chains, a sprocket having two sets of effective teeth. Tooth spaces for the second set are located midway between those of the first set.

double front (P.P.)
A boiler front consisting of two spaced sheets between which air is passed on the way to burners.

double hung window (arch.)
A window consisting of an upper and lower sash in a frame.

double inclined grate (P.P.)
A grate consisting of two parts, so placed and inclined to form a figure V.

double offset (P.P.)
Two piping offsets in succession or in series in the same line.

double-pitch roller chain (E.M.)
A roller chain having double the pitch of a standard roller chain, otherwise having standard pins, bushings and rollers.

double studding (arch.)
Two pieces of studding spiked together to form the openings for doors and windows.

doughnutting (P.P.)
The formation of a "ring" or "collar" made up of total solids deposited from the boiler water concentration. This usually occurs at the water line in a tube partly filled with water. Also may occur at the entrance of submerged downcomers through which feedwater passes.

dovetailing (arch.)
In carpentry and joinery, the method of fastening boards or other timbers together by letting one piece into another in the form of the extended tail of a dove.

dowel (arch.)
(1) A round piece of wood.
(2) A pin let into two pieces of wood or stone where they are joined together.

(3) A piece of wood driven into a wall so that other pieces can be nailed to it. This is also called plugging.

dowel joint (arch.)
A joint made by gluing a dowel into two pieces of wood.

downcomer (P.P.)
A tube in a boiler or water wall system through which fluid flows downward.

downcomer tube
See supply tube.

downspout (arch.)
The vertical portion of a rain-water conductor.

draft (P.P.)
The difference between atmospheric pressure and some lower pressure existing in the furnace or gas passages of a steam generating unit.

draft differential (P.P.)
The difference in static pressure between two points in a system.

draft gage (P.P.)
A device for measuring draft, usually in inches of water.

draft loss (P.P.)
The difference in the static pressure of a gas between two points in a system, both of which are below atmospheric pressure, and caused by resistances to flow. Usually measured in inches water gage ("w.g.").

drag plate (P.P.)
A plate beneath a traveling or chain grate stoker used to support the returning grates.

drag seal (P.P.)
In a chain grate stoker the hinged plate resting against the returning chain and used to seal the air compartments.

drain (arch.)
A sewer or other pipe or conduit used for conveying ground water, surface water, storm water, waste water, or sewage.

drain cock (arch.)
A device which permits water to be drained from the coils when the heating system is not operating.

drain tile (arch.)
Sectional tile pipe designed to be laid in drainage ditches to carry surface water away from the outside of the foundation wall of a house.

drainage fitting (arch.)
A cast-iron threaded fitting used on drainage pipes. A distinctive feature is the shoulder against which the connecting pipe rests so as to present a smooth and continuous interior surface. Sometimes called a "Durham fitting."

drawing (heat treat)
A misnomer for tempering.

dresser (P.P.)
A tool used for straightening lead pipe and sheet lead.

dresser joint (P.P.)
See "normandy joint."

dressing (arch.)
The operation of squaring and smoothing stones or lumber for building.

drier (F.&C.)
An apparatus for the removal of part or all of the water or moisture from the fuel.

drift (arch.)
To drive a wooden plug through a lead pipe or trap to remove dents. See "drift plug."

drift—elastic drift (E.M.)
See "creep."

drift plug (arch.)
The plug used in drifting.

driftbolt (arch.)
(1) Metal rod used to fasten heavy timbers.
(2) Bolt used to drive other bolts or pins out of their lodging places.

drilling
Cutting a hole with spiral-edged cutting tool called a drill. This is a very common operation preceding such finish or secondary operations as TAPPING, BROACHING, BORING, REAMING, and others. It may be done at any angle—vertical, horizontal, or oblique.

drip (arch.)
The member of a cornice that has a projection beyond the other parts for the purpose of throwing off small quantities of water, drop by drop.

drip-stone (arch.)
The label molding that serves for an opening on a canopy and also serves to throw off the rain. It is also called weather molding.

drop ell (P.P.)
An ell with lugs in the sides by means of which it can be attached to a support.

drop panel (arch.)
The structural portion of a flat slab which is thickened in the area surrounding the column or column capital.

drop siding (arch.)
Siding which is usually ¾" thick and 6" wide and which can be machined into various patterns. It has tongue-and-

groove or shiplap joints, is heavier and has more structural strength than bevel siding.

drop tee (P.P.)
A tee with lugs in the sides by means of which it can be attached to a support.

drum
A cylindrical shell closed at both ends designed to withstand internal pressure.

drum baffle (P.P.)
A plate or series of plates or screens placed within a drum of a boiler to divert or change the direction of the flow of water or water and steam.

drum course (P.P.)
A cylindrical section of a drum.

drum head (P.P.)
A place closing the end of a boiler drum or shell.

drum internals (P.P.)
All apparatus within a drum.

drum operating pressure (P.P.)
The pressure of the steam maintained in the steam drum or steam-and-water drum of a boiler in operation.

drum trap (arch.) or (P.P.)
A trap consisting of a cylinder with its axis vertical. The cylinder is larger in diameter than the inlet or outlet pipe; it is usually about 4 in. in diameter with 1½ in. inlet and outlet pipes.

dry, ash free basis (F.&C.)
The method of reporting fuel analysis with ash and moisture eliminated and remaining constituents recalculated to total 100%.

dry, mineral matter free basis (F.&C.)
The method of reporting fuel analysis with moisture and ash, plus other mineral matter eliminated and remaining constituents recalculated to total 100%.

dry air
Air with which no water vapor is mixed. This term is used comparatively, since in nature there is always some water vapor included in air, and such water vapor, being a gas, is dry.

dry-ash (P.P.)
Refuse in the solid state, usually in granular or dust form.

dry-ash removal (F.&C.)
The method of accumulating and removing dry ash from a dry bottom pulverized fuel fired furnace.

dry-bottom furnace (P.P.)
A pulverized-fuel fired furnace in which the ash particles are deposited on the furnace bottom in a dry, non-adherent condition.

dry-bulb temperature
The temperature of the air indicated by thermometer not affected by the water vapor content of the air.

dry fuel basis (F.&C.)
The method of reporting fuel analysis with moisture eliminated and other constituents recalculated to total 100%. See "dry, ash free basis."

dry gas
Gas containing no water vapor.

dry-gas loss (P.P.)
The loss representing the difference between the heat content of the dry exhaust gases and their heat content at the temperature of ambient air.

dry pipe (P.P.)
A perforated or slotted pipe or box inside the drum of a boiler and connected to the steam outlet.

dry rot (arch.)
A rapid decay of timber in which its substance is converted into a dry powder which issues from small cavities and resembles the boring of worms. It is usually caused by alternating dryness and dampness.

dry steam
Steam containing no moisture. Commercially dry steam containing not more than one half of one percent moisture.

dry-steam drum (P.P.)
A pressure chamber, usually serving as the steam offtake drum, located above and in communication with the steam space of a boiler steam-and-water drum.

dry vent (arch.)
A vent in a plumbing system that does not carry water or water-borne wastes.

dry-wall construction (arch.)
Any interior wall or ceiling material that does not have to be mixed with water before it can be applied. A plaster wall or ceiling, on the other hand, is called wet-wall construction.

dry well (arch.)
A hole in the earth filled with stones or gravel, used to collect water from the roof of a house.

d.s. glass (arch.)
Double-strength glass, used for glazing large windows.

dual-flow oil burner
A burner having an atomizer, usually mechanical, having

two sets of tangential slots, one set being used for low capacities and the other set for high capacities.

dual vent
Same as "unit vent."

duct
A passage for air or gas flow.

Dulong's formula
A formula for calculating the approximate heating value of solid fuels from the ultimate analysis.

dummy diagram (E.M.)
An equivalent diagram of a system of forces acting upon a framework showing the rectangular components of the forces instead of the actual forces.

dump grate stoker (F.&C.)
One equipped with movable ash trays, or grates, by means of which the ash can be discharged at any desirable interval.

dump plate (F.&C.)
An ash supporting plate from which ashes may be discharged by rotation from one side of the plate.

durham fitting (arch.)
See "drainage fitting."

dust
Particles of gas borne solid matter larger than one micron in diameter.

dust collecting fan
A centrifugal fan which concentrates dust and skims the dust into a cyclone or hopper.

dust loading
The amount of dust in a gas, usually expressed in grains per cu. ft. or lb. per thousand lb. of gas.

dust ram (F.&C.)
Plunger apparatus for returning cinders or dry ash into a furnace.

dust-tight valve (F.&C.)
A valve used to shut off burner lines or any line carrying fuel in suspension.

dusting door (P.P.)
A door located in a boiler wall to provide access for blowing dust off tubes by a hand lance.

dustless unloader (F.&C.)
A device for wetting dust so that particles are adherent to each other, to prevent dissipation by atmospheric current while conveying.

dutch door (arch.)
A door so constructed that the lower part can be shut while the upper part remains open.

dutch oven (arch.)
A furnace that extends forward of the wall of a boiler setting. It usually is of all refractory construction with a low roof, although in some cases the roof and side walls are water cooled.

dutchman (P.P.)
A lead nipple not more than about 1 in. long that is placed in a wiped joint to make up the desired length in joining two pipes which are too short.

dwelling
A building intended for the residence of not more than two families.

dynamic equilibrium (E.M.)
If the inertia force in an accelerating system is considered

oppositely directed from the motion, the system is considered in dynamic equilibrium.

dynamo (elect.)

A machine for converting mechanical energy into electrical energy or vice versa.

dyne

That force which imparts an acceleration of one centimeter per second squared to a mass of one gram.

earthquake bracing (arch.)
Diagonal bracing between columns of a structure designed to withstand violent lateral motion of the structure.

eaves (arch.)
That portion of the roof which extends beyond the walls.

ebullition
The act of boiling or bubbling.

eccentric fitting (P.P.)
A pipe fitting in which the center line of the run is offset in the fitting.

eccentricity (E.M.)
The deviation of a load from the central axis. The perpendicular distance from the load to the central axis of the body is called the eccentricity.

economizer (P.P.)
A heat recovery device designed to transfer heat from the products of combustion to a fluid, usually feedwater to a boiler.

eddy
A whirlpool of gas.

eddy current (elect.)
An electric current induced in the core of an armature of a motor, dynamo, or transformer caused by changes in the magnetic field.

eductor

Means using water, steam or air to induce the flow of other fluids from a vessel. (See injector.)

effective area of concrete (arch.)

The area of a section which lies between the centroid of the tensile reinforcement and the compression face of the flexural member.

effective area of reinforcement (arch.)

The area obtained by multiplying the right cross-sectional area of the reinforcement by the cosine of the angle between its direction and the direction for which the effectiveness is to be determined.

effective force (E.M.)

The net force acting in any system.

effective teeth (E.M.)

The number of sprocket teeth that engage the chain rollers during one revolution of the sprocket. The term applies to sprockets for double-pitch roller chains.

efficiency

In any system involving an effect, the ratio of the output to the input is called the efficiency. This ratio is usually multiplied by 100 in order that the efficiency may be given as a percentage.

efflorescence (arch.)

The appearance of a white crust or powder on the surface of stone or brick walls. It is caused by the presence of mineral salts in the wall.

ejector (P.P.)

A device which utilized the kinetic energy in a jet of water or other fluid to remove a fluid or fluent material from tanks or hoppers.

elastic (E.M.)
A material which is able to sustain stress without permanent deformation is said to be elastic. The term is also used to denote conformity to the stress-strain law.

elastic axis (E.M.)
The line that passes through the elastic center of a beam. The term is usually applied to an aircraft wing.

elastic center (E.M.)
That point which is midway between the center of twist and the flexural center.

elastic curve (E.M.)
The curve formed by the neutral axis of a loaded beam provided the beam is not stressed beyond the proportional limit.

elastic deformation (E.M.)
A deformation which will return to normal upon the removal of stress.

elastic impact (E.M.)
The action of two or more colliding bodies which are at first deformed and then spring apart because of the action of the restoring elastic forces.

elastic limit (E.M.)
That stress point where permanent deformation is incipient.

elastic ratio (E.M.)
The ratio of elastic limit to ultimate strength.

elbow (P.P.)
A pipe fitting joining two pipes at an angle.

electric boiler
A boiler in which electric heating means serve as the source of heat.

electrode (elect.)

The terminal by which current leaves or enters an electrolytic cell.

electrode holder (weld.)

An electrode holder is a device used in the arc-welding process for mechanically holding the electrode and conducting the electric current from the electrode lead terminal to the electrode.

electrodes for welding cast iron (weld.)

(1) Ferrous electrodes having a mild steel or cast iron core principally used for the welding of cast iron.

(2) Non-ferrous electrodes principally used for the welding of cast iron.

electrolyte (elect.)

A substance that conducts a current by the movement of ions.

electromagnet (elect.)

A magnet made by passing current through a coil of wire wound on a soft iron core.

electromotive force (abbreviated EMF) (elect.)

The electrical force that moves or tends to move electrons.

electron (elect.)

The smallest particle of negative electricity.

electroplating (elect.)

The electrical method of plating a surface with a metal.

electrostatic precipitator (P.P.)

A device for collecting dust, mist or fume from a gas stream, by placing an electrical charge on the particle and removing that particle onto a collecting electrode.

element (P.P.)

An integral heat absorbing assembly which with other

similar or identical units can be assembled into a heat recovery device such as a boiler, superheater, economizer or air heater.

elevation (arch.)
(1) The front facade of a structure;
(2) a geometrical drawing of the external upright parts of a building.

elevation drawing (arch.)
One which shows one side of the outside of the finished house, from the ground floor to the roof. It indicates door and window sizes, height of each floor, kind of sizing used, etc.

ell
Same as "elbow."

ellipsoid of strain (E.M.)
The shape assumed by a sphere under stress showing the state of strain at a given point.

ellipsoid of stress (E.M.)
An ellipsoid that shows the state of stress at a given point.

elutriation (P.P.)
The determination of particle size by an elutriator.

elutriator (P.P.)
A device used to determine particle size based on the principle that a definite size range of particles will be borne by definite fluid velocities.

embrittlement cracking (P.P.)
A form of metal failure that occurs in steam boilers at riveted joints and at tube ends, the cracking being predominantly intercrystalline.
Note: This form of cracking, which has been known as "caustic embrittlement," is believed to result from the action

of certain constituents of concentrated boiler water upon steel under stress.

emery paper
An abrasive paper used on metal.

encased knot (arch.)
A knot whose rings of annual growth are not intergrown and homogeneous with those of the surrounding wood.

Note: The encasement may be partial or complete; if intergrown partially or so fixed by growth or position that it will retain its place in the piece, it shall be considered a tight knot; if completely intergrown on one face, it is a watertight knot.

end check (arch.)
A check occurring at an end of a piece of lumber.

end-construction tile (arch.)
Tile designed to receive its principal stress parallel to the axes of the cells.

end-match lumber (arch.)
Boards having the ends as well as the sides tongued and grooved.

endothermic reaction (P.P.)
A reaction which occurs with the absorption of heat.

endurance limit (E.M.)
See fatigue strength.

endurance ratio (E.M.)
The ratio of the endurance limit or fatigue strength to the ultimate static tensile strength.

endurance strength (E.M.)
The maximum stress (usually bending) that can be repeatedly applied without rupture to the material.

energy

Energy is the capacity for producing an effect.

Kinetic energy is the energy possessed by a body by virtue of its velocity. Quantitatively it is computed by the expression:

$$KE = \tfrac{1}{2}mv^2$$

where

KE = kinetic energy (the unit of KE in the English system is ft. lbs.)

m = mass

v = velocity

Potential energy is the energy possessed by a body by virtue of its position above some datum.

Conservation of energy is a physical law which states that energy can neither be created nor destroyed.

energy of rupture (E.M.)

A criterion established in terms of work done per unit volume in producing fracture. This is useful for comparing the toughness of different materials.

ensemble

The work or composition considered as a whole and not in parts.

entrainment (P.P.)

The conveying of particles of water of solids from the boiler water by the steam.

entry (arch.)

A hall without stairs or vestibule.

equalizer (P.P.)

Connections between parts of a boiler to equalize pressures.

equilibrium (E.M.)

Equilibrium is the state of a body being at rest or in uni-

form motion. It should be noted that uniform motion is merely a special case of equilibrium.

equilibrium, rotational (E.M.)

When the sum of torques on a body is equal to zero, we have rotational equilibrium. A body rotating at constant speed is merely a special case of a body at rest and therefore must also be considered in rotational equilibrium.

equivalent bending moment (E.M.)

The bending moment which will give the same tensile or compressive stress in a circular shaft as that produced by a combined loading of torsion and bending.

equivalent evaporation (P.P.)

Evaporation expressed in pounds of water evaporated from a temperature of 212° F to dry saturated steam at 212° F.

equivalent twisting moment (E.M.)

The twisting moment which will give the same shear stress in a circular shaft as that produced by a combined loading of torsion and bending.

erosion

Wearing away of surfaces due to impingement of gas-borne dust particles.

erosion (F.&C.)

The wearing away of refractory or of metal parts by the action of slag or fly ash.

error (A.C.)

The difference between the indicated and true value in a measurement. Thus: indicated value — true value.

error in measurement (A.C.)

The algebraic difference between a value which results from measurement and the corresponding true value. A posi-

tive error denotes that the measured value is algebraically greater than the true value. Error is usually expressed in the units of the measured quantity, or as a fraction (or percent) of the full scale value, or the actual value.

escutcheon (arch.)
(1) The metal plate on doors around the knobs and keyhole.
(2) A flange used to cover an opening in a floor or wall.

evaporated make-up (P.P.)
Distilled water used to supplement returned condensate for boiler feed water.

evaporation
The change of state from a liquid to a vapor.

evaporation rate (P.P.)
The number of pounds of liquid (usually water) evaporated in a unit of time.

evaporator (F.&C.)
A vessel from which part or all of the water in the contained liquid mixture is removed by evaporation, the usual source of heat being immersed elements containing a heated fluid.

evase stack (P.P.)
An expanding connection on the outlet of a fan or in an air flow passage for the purpose of converting kinetic energy to potential energy, i.e., velocity pressure into static pressure.

excavate (arch.)
To dig out.

excess air (F.&C.)
Air supplied for combustion in excess of that theoretically required for complete oxidation.

exhaust steam (P.P.)
Steam discharged from a prime mover.

exhauster (F.&C.)
A fan connected to the outlet of a pulverizer and used to draw pulverizer air through a pulverizer and in some cases to augment the pulverizer air by the addition of primary air.

exhauster
A fan used to withdraw air or gases under suction.

exothermic reaction
A reaction which occurs with the evolution of heat.

expanded joint (P.P.)
The pressure tight joint formed by enlarging a tube end in a tube seat.

expander (P.P.)
The tool used to expand tubes.

expansion bolt (arch.)
A bolt designed for anchoring in masonry.

expansion joint (arch.)
The joint to permit movement due to expansion without undue stress.

explosion
Combustion which proceeds so rapidly that a high pressure is generated suddenly.

explosion door (P.P.)
A door in a furnace or boiler setting designed to be opened by a pre-determined gas pressure.

extended surface (P.P.)
Metallic heat absorbing surface protruding beyond the tube wall of a boiler.

extended surface (P.P.)
Heating surface in the form of fins, rings, or studs added to heat absorbing elements.

external-mix oil burner (P.P.)
A burner having an atomizer in which the liquid fuel is struck, after it has left an orifice, by a jet of high velocity steam or air.

external treatment (P.P.)
The treatment of boiler and feed water prior to its introduction into the boiler.

externally fired boiler (P.P.)
A boiler in which the furnace is essentially surrounded by refractory or water-cooled tubes.

extension furnace
See dutch oven.

F

facade (arch.)
Generally speaking, all of the exterior side of a building that can be seen at one view: strictly speaking, the principal front.

face (arch.)
The front of a wall or brick.

face mold (arch.)
A pattern for making the board from which ornamental hand railings and other works are to be cut.

face nailing (arch.)
To nail perpendicular to the initial surface or to the junction of the pieces being joined.

face of tooth (E.M.)
That surface of the tooth which is between the pitch circle and the top of the tooth.

face width (E.M.)
Width of the pitch surface. The ACTIVE FACE WIDTH is the width which actually makes contact with a mating gear. When herringbone gears have a central clearance groove, the width of this groove is not included in the active face width.

factor of safety (E.M.)
The ratio of the load which will cause rupture in a member to the applied load.

factor of stress concentration (E.M.)
Where there is a stress concentration due to irregularities

in sections, the ratio of the maximum stress to the stress calculated using the net section is called the factor of stress concentration.

factor of utilization (E.M.)

The ratio of allowable stress to ultimate strength; the reciprocal of the factor of safety when the stress is proportional to the load.

fan

A machine consisting of a rotor and housing for moving air or gases at relatively low pressure differentials.

fan inlet area

The inside area of the fan inlet collar or connection.

fan performance

A measure of fan operation in terms of volume, total pressures, static pressures, speed, power input, mechanical and static efficiency, at a stated air density.

fan performance curves

The graphical presentation of total pressure, static pressure, power input, mechanical and static efficiency as ordinates and the range of volumes as abscissa, all at constant speed and air density.

fan requirements—recommended or specified

The fan requirements recommended by the manufacturer of the steam generating equipment which will include necessary tolerances to overcome unfavorable operating conditions.

fatigue or fatigue failure (E.M.)

Failure of a member under repetitive stress. The repetitive stress is less than the ultimate static strength.

fatigue strength (E.M.)

The maximum load that can be repeatedly applied without producing fracture.

fatigue strength reduction factor (E.M.)
The ratio of the endurance limit of a member to the nominal stress of a member having a stress raiser.

faucet
A valve on a water pipe by means of which water can be drawn from or held within the pipe. The valve is placed on the end of the pipe.

feed pipe (P.P.)
A pipe through which water is conducted into a boiler.

feed trough (P.P.)
A trough or pan from which feed water overflows in the drum of a boiler.

feed water (P.P.)
Water introduced into a boiler during operation. It includes make-up and return condensate.

feed-water treatment (P.P.)
The treatment of boiler feed water by the addition of chemicals to prevent the formation of scale or eliminate other objectionable characteristics.

feeder tube
See supply tube.

female thread (P.P.)
A thread on the inside of a pipe or fitting. Preferably called an "inside thread."

ferric percentage (F.&C.)
Actual ferric iron in slag, expressed as percentage of the total iron calculated as ferric iron.

ferrule (P.P.)
A short metallic ring rolled into a tube hole to decrease its diameter. Also a short metallic ring rolled inside of a rolled

tube end. Also, a short metallic ring for making up hand hole joints.

ferrule (arch.)

(1) A metallic sleeve, calked or otherwise, joined to an opening in a pipe, into which a plug is screwed that can be removed for the purpose of cleaning or examining the interior of the pipe.

(2) The metal portion of a paint brush at the base of the bristle.

fiber stress (E.M.)

A term used to denote logitudinal stresses in a member. *Stress in extreme fiber* is used to denote the stress at the extreme points from the neutral axis.

field (F.&C.)

Fuel producing region, i.e., coal field; oil field.

field (elect.)

The region where a magnet or electrical charge is capable of exerting its force.

field coil (elect.)

A coil used to excite a field magnet.

field magnet (elect.)

The magnet used to produce a magnetic field (usually in motors or generators).

field stones (arch.)

Rough, uncut local stones.

filler (arch.)

In painting, a material used to fill the wood pores. Also, a gravel or cinder base for laying concrete.

filler metal (weld.)

Filler metal is the material that is added to the base metal

to produce the weld in some forms of the fusion welding process.

filter

Porous material through which fluids or fluid-and-solid mixtures are passed to separate matter held in suspension.

filter (cloth)

A porous fabric which separates dust from a gas stream allowing the gas to pass through.

filter lens

A filter lens is a colored glass used in goggles, helmets, shields to exclude harmful light rays.

fin (P.P.)

A strip of steel welded longitudinally to a tube.

fin superheater (P.P.)

A superheater made up of elements with extended surface of fin form.

fin tube (P.P.)

A tube with one or more fins.

fin tube wall (P.P.)

Spaced waterwall tubes on which flat metal extensions are welded in a plane parallel to the wall.

final control element (A.C.)

That portion of the controlling means which directly changes the value of the manipulated variable.

fine aggregate (arch.)

Natural sand, or sand prepared from stone, blast furnace slag or gravel, or, subject to the approval of the Commissioner of Buildings, other inert materials having similar characteristics. See aggregate.

fineness (P.P.)

The percentage by weight of a standard sample of a pul-

verized material which passes through a standard screen of specified mesh when subjected to a prescribed sampling and screening procedure.

fines (P.P.)
Sizes below a specified range. See "fineness."

finish
The final surface when completed.

finishing (arch.)
All work done after the roughing-in.

fire box (P.P.)
The equivalent of a furnace. A term usually used for the furnaces of locomotive and similar types of boilers.

fire brick (P.P.)
Special bricks used in fireplaces and furnaces because of their ability to withstand heat.

fire clay (P.P.)
A special heat-resisting cement used to bond fire bricks.

fire crack (P.P.)
A crack starting on the heated side of a tube, shell, or header resulting from excessive temperature stresses.

fire point (F.&C.)
The lowest temperature at which, under specified conditions, fuel oil gives off enough vapor to burn continuously when ignited.

fire resistant
A material that will resist fire but is not absolutely fireproof.

fire stop (arch.)
A piece of studding used in wall construction to prevent fire from rising through the air space between inner and outer wall.

fire-tube (P.P.)
A tube in a boiler having water on the outside and carrying the products of combustion on the inside.

fire wall
See wall, fire.

fired pressure vessel (P.P.)
A vessel containing a fluid under pressure exposed to heat from the combustion of fuel.

fireplace (arch.)
That part of a building designed to permit the making of open fires. It is a recess in the wall or chimney-breast which connects directly with a flue for smoke. The recess or space is enclosed on the sides by two jambs or cheeks, and it terminates in the flue above. The decoration of the fireplace is important because that one part is wholly different in its uses, and probably in materials as well, from the rest of the room.

fireproofing tile (arch.)
Tile for use as a protection for structural members against fire.

firing door (P.P.)
A door in a furnace through which coal or other solid fuel is introduced into the furnace.

firm red heart (arch.)
A stage of incipient decay in wood characterized by a reddish color produced in the heartwood, which does not, however, make the wood unfit for the majority of yard purposes. It is caused by the fungus *Trametes pini* and occurs chiefly in the pines.

first story (arch.)
The story, the floor of which is at or first above the level of the sidewalk.

fish joint (arch.)

A splice where two pieces are joined butt-end to end. The connection is made by pieces of wood or iron placed on each side and firmly bolted to the timbers or other pieces being joined.

fish tape (elect.)

A length of steel wire that can be pushed around bends or through a rigid conduit.

fishtail burner (P.P.)

A burner consisting of a diverging chamber having a rectangular outlet which is materially longer than wide.

fittings (P.P.)

Parts of a pipe line other than straight pipe or valves, such as couplings, elbows, tees, unions and increasers.

fixed (beam or column) (E.M.)

A beam or column which is restrained at the ends so that it will not rotate in the plane of bending. Syn. clamped, built in, encastré.

fixed ash (F.&C.)

That portion of the ash derived from the original vegetation including all intimately contained minerals.

fixed carbon (F.&C.)

The carbonaceous residue less the ash remaining in the test container after the volatile matter has been driven off in making the proximate analysis of a solid fuel.

fixed grate (P.P.)

A grate in a boiler which does not have movement.

fixture (P.P.)

A receptacle attached to a plumbing system other than a trap in which water or wastes may be collected or retained for ultimate discharge into the plumbing system.

fixture branch (P.P.)
The supply pipe between the fixture and the water distributing pipe.

fixture drain (P.P.)
The drain from the trap of a fixture to the junction of the drain with any other drain pipe.

flagstones (arch.)
Stone or concrete slab, from one to three inches thick, used for floors or walks.

flame (F.&C.)
A luminous body of burning gas or vapor.

flame annealing (heat treat)
Annealing in which the heat is applied directly by a flame.

flame detector (A.C.)
A device which indicates if a fuel is burning or if ignition has been lost. The indication may be transmitted to a signal or to a control system.

flame hardening (heat treat)
Quench hardening in which the heat is applied directly by a flame.

flame plate (F.&C.)
A baffle of metal or other material for directing gases of combustion.

flame-propagation rate (F.&C.)
Speed of travel of ignition through a combustible mixture.

flammability (F.&C.)
Susceptibility to combustion.

flange (arch.)
A projecting edge, rim, or rib. Flanges are often cast on the top or bottom of iron columns, to fasten them to those

above or below. The top and bottom of I-beams and channels are called the flange.

flange union (P.P.)
A pair of flanges to be threaded onto the ends of pipes to be joined. The flanges are bolted together when the pipes are joined.

flank of tooth (E.M.)
That surface which is between the pitch circle and the bottom land. The flank includes the fillet.

flare type burner (P.P.)
A circular burner from which the fuel and air are discharged in the form of a cone.

flareback (F.&C.)
A burst of flame from a furnace in a direction opposed to the normal flow, usually caused by the ignition of an accumulation of combustible gases.

flared tube-end (P.P.)
The projecting end of a rolled tube which is expanded or rolled to a conical shape.

flash point (F.&C.)
The lowest temperature at which, under specified conditions, fuel oil gives off enough vapor to flash into momentary flame when ignited.

flashing (P.P.)
Steam produced by discharging water at saturation temperature into a region of lower pressure.

flashing (arch.)
(1) Strips of lead, tin, or copper that are let into the joints of a wall so as to lap over gutters or other pieces;
(2) pieces worked in the slates or shingles around dormers, chimneys, and other rising parts, to prevent leaking.

(3) A piece of sheet metal fitted under another piece of flat metal or wood over which water is expected to run.

flat flame burner (P.P.)

A burner terminating in a substantially rectangular nozzle, from which fuel and air are discharged in a flat stream.

flat slab (arch.)

A concrete slab reinforced in two or more directions, generally without beams or girders to transfer the loads to supporting columns.

flatting (arch.)

Painting finished without leaving a gloss of the surface.

flet paper (arch.)

Heavy paper used in construction work for insulating purposes.

flexural (or shear) center (E.M.)

That point on a beam through which a traverse load must act to produce pure bending.

flight (arch.)

A run of steps or stairs from one landing to another.

floating (arch.)

The equal spreading of plaster or stucco on the surface of a wall by means of a board called a float. As a general rule, only rough plastering is floated.

floating action (A.C.)

That in which there is a predetermined relation between the deviation and the speed of a final control element.

floating-average-position action (A.C.)

Is that in which there is a predetermined relation between deviation (of the controlled variable) and the rate of change of the time-average position of a final control element which is moved periodically from one of two fixed positions to the other.

floating rate (automatic controls applying to proportional-speed floating controller action)

The ratio of the speed of the final control element to the deviation.

floating speed (automatic controls applying to single or multiple speed controller action)

The rate of motion of the final control element. Floating speed is commonly expressed in percent of full range motion per minute.

flood level

The level in a fixture at which water begins to overflow the top or rim of the fixture.

floor plan (arch.)

A drawing which shows the arrangement of rooms and partitions on a single floor. It also indicates the location of each door, window, stairway, fireplace, and the like.

floor tile (arch.)

Tile for use as structural units in floor and roof construction.

flow out

In painting, the ability of some paints to dry without brush-marks.

flue (P.P.)

The space or a passage in a chimney for products of combustion. Each passage is called a flue, while all together make the chimney.

flue dust (P.P.)

The particles of gas-borne solid matter carried in the products of combustion.

flue gas (P.P.)

The gaseous products of combustion in the flue to the stack.

fluid temperature (F.&C.)
The temperature at which a standard ash cone fuses down into a flat layer on the test base, when heated in accordance with a prescribed procedure.

fluidizing
Causing a mass of finely divided solid particles to assume some of the properties of a fluid, as by aeration.

flush
The continued surface, in the same plane, of two contiguous masses.

flush bushing (arch.)
A bushing, without a shoulder, that fits flush into the fitting with which it is to connect.

flush valve (arch.)
A valve used for flushing a fixture by using water directly from the water-supply pipes or in connection with a special flush tank.

flux (weld.)
Flux is the material used in welding to prevent the formation of oxides, nitrides or other undesirable inclusions in the weld and to eliminate those which have formed. In metal arc welding it is also employed to aid in the retention of the various elements of the electrodes and to retard the rate of cooling of the weld metal.

flux (elect.)
Magnetic lines of force, assumed to flow from the north pole to the south pole of a magnet.

fluxing (P.P.)
The addition of chemicals to reduce the ash fluid temperature.

fly ash (P.P.)
The fine particles of ash which are carried by the products of combustion.

foaming
The continuous formation of bubbles which have sufficiently high surface tension to remain as bubbles beyond the disengaging surface.

fog quenching (heat treat)
Quenching in a fine vapor or mist.

follower (P.P.)
Part of a threading tool for pipes that keeps the thread straight.

footing (arch.)
The lower part of a foundation that rests on the ground; the base.

force (E.M.)
A force is a push or pull which changes the state of motion of a body. A force which is exerted from an external source is called an *external force*. A force exerted on one part of a body from another part of the same body is called an internal force.

Composition of forces, see composition of vectors.

Concurrent forces. When the lines of action of a force system pass through the same point, it is called a *concurrent force system.*

Coplanar forces. When the lines of action of a force system lie in the same plane, we call it a *coplanar force system.*

force-displacement diagram (E.M.)
A curve depicting the relationship of force with displacement. The resultant force is plotted as the ordinate and the displacement as abscissa.

force-time curve (E.M.)

A curve depicting the relationship of force with time. The resultant force is plotted as the ordinate and the time as abscissa.

forced circulation (P.P.)

The circulation of water in a boiler by mechanical means external to the boiler.

forced draft fan (P.P.)

A fan supplying air under pressure to the fuel burning equipment.

forced draft stoker (F.&C.)

A stoker in which the flow of air through the grate is caused by a pressure produced by mechanical means.

forced vibration (E.M.)

Any disturbing force acting upon and moving a body at periodic intervals produces a forced vibration in that body.

forging

Shaping mass metal by hammering while it is in a heated stage. Forging improves the grain structure of steel, tending to make it very tough when annealed properly. Irregular shaped parts requiring great strength and toughness are usually forged. Practices involved in forging should be studied by the tool designer if he is to design forging dies.

form (arch.)

Mold used to shape poured masonry.

form factor (E.M.)

The ratio of the modulus of rupture of a beam to the modulus of rupture of a similar beam having a section which is adopted as standard.

In electricity the *form factor* as applied to a symmetrical

alternating current is the ratio of the effective value of the current to the average value of its half-period.

forming (metal working)
Forming irregular shapes with a die, out of sheet steel by means of a press exerting a great pressure. Forming is usually preceded by BLANKING.

fouling (P.P.)
The accumulation of refuse in gas passages or on heat absorbing surfaces which results in undesirable restrictions to the flow of as or heat.

foundation (arch.)
The supporting portion of a structure, below the first-floor construction or grade, including the footings.

foundation tile (arch.)
Tile for use as load-bearing stuctural units in foundation walls.

foundation wall
See wall, foundation.

fracture (P.P.)
The breaking of dust particles into smaller sizes.

framing (arch.)
See balloon framing, braced framing, and platform framing.

frapping (arch.)
Several turns of rope around lashing turns, used to keep the lashing uniform and tight.

free ash (P.P.)
Ash which is not included in the fixed ash.

free-body diagram (E.M.)
A schematic diagram depicting the external forces acting upon a body is called a free-body diagram.

free moisture (P.P.)
Same as "surface moisture."

free-rolling body (E.M.)
Any rolling motion that occurs without slipping is identified as a free-rolling body.

french coupling (P.P.)
A coupling with a right and left hand thread.

french door (arch.)
A door in which panes of glass are substituted for wooden panels.

frequency
The rate of recurrence of a motion in a unit of time.

frequency (elect.)
The number of cycles of an alternating current per second.

fresh-air inlet (arch.)
A connection, made to a house drain above the house or main trap, leading to the outside air.

friability (F.&C.)
The tendency of a coal to crumble or break into small pieces.

friction (E.M.)
Friction is that force which opposes the motion of a body over another.

Static friction is that force opposing and preventing the motion of a body over another.

Kinetic friction is that force which opposes the motion of a moving body over another.

Rolling friction is the force opposing the rolling of a body over the surface of another.

Sliding friction is the force opposing the sliding of a body over the surface of another.

Angle of friction is the angle whose tangent is equal to the coefficient of friction

$$\tan \alpha = \frac{Fr}{N} = \mu$$

Coefficient of friction is the ratio of the friction force acting on a body to the force normal to the plane of motion. It is defined mathematically by:

$$U = \frac{Fr}{N} \text{ where}$$

U = coefficient of friction
Fr = friction force
N = normal force

front (arch.)
That face of a building which contains the principal entrance.

front discharge stoker (P.P.)
A stoker so arranged that refuse is discharged from the grate surface at the same end as the coal feed.

frost line (arch.)
The depth to which the earth freezes.

frostproof closet (arch.)
A long-hopper water closet in which the water in the trap is placed below the frost line.

fuel
A substance containing combustible used for generating heat.

fuel-air mixture
Mixture of fuel and air.

fuel-air ratio
The ratio of the weight, or volume, of fuel to air.

fuel-bed (P.P.)
Layer of burning fuel on a furnace grate.

fuel bed resistance
The static pressure differential across a fuel bed.

fuel oil
A liquid fuel derived from petroleum or coal.

full annealing (heat treat)
Annealing a ferrous alloy by autenitizing and then cooling slowly through the transformation range.

full power
Used in marine practice to denote operation at maximum capacity or output.

Fuller faucet (P.P.)
A faucet in which the flow of water is stopped by means of a rubber ball that is forced into the opening.

fume (P.P.)
Suspended particles in gas, ranging, from 0.1 micron to 1 micron.

furnace
An enclosed space provided for the combustion of fuel.

furnace cooling factor (P.P.)
Furnace cooling factor is the heat available per sq. ft. of heat absorbing surface in the furnace. That surface is the projected area of tubes and extended metallic surfaces on the furnace side including walls, floor, roof, partition walls, and platens and the area of the plane of the furnace exit which is defined as the entrance to the convection tube bank.

furnace draft (P.P.)
The draft in a furnace, measured at a point immediately in front of the highest point at which the combustion gases leave the furnace.

furnace slag screen (P.P.)
A screen formed by one or more rows of tubes arranged across a furnace gas outlet, serving to create an ash cooling zone for the particles suspended in the products of combustion leaving the furnace.

furnace volume (P.P.)
The cubical contents of the furnace of combustion chamber.

furring (arch.)
Strips of wood or metal that are attached to a wall or other surface to even it, form an air space, make it appear thicker, or serve as a base for laths, wallboard, or insulation.

furring tile (arch.)
Tile for lining the inside of walls and carrying no superimposed loads.

fuse (elect.)
A part of a circuit made of a material that will melt and break the circuit when current is increased beyond a specific value.

fused slag (F.&C.)
Slag which has coalesced into a homogeneous solid mass by fusing.

fusible plug
A hollowed threaded plug having the hollowed portion filled with a low melting point material, usually located at the lowest permissible water level.

fusibility (P.P.)
Property of slag to fuse and coalesce into a homogenous mass.

fusion
The melting of ash.

fusion welding (weld.)

Fusion welding is a group of processes in which metals are welded together by bringing them to the molten state at the surfaces to be joined, with or without the addition of filler metal, without the application of mechanical pressure or blows.

G

gable (arch.)

The triangular portion at the end of a building. That portion of a wall contained between the slopes of a double-sloped roof; on a single-sloped roof, that portion contained between the slope of, and a line projected horizontally through, the lowest elevation of the roof construction.

gauge or gage

(1) To mix plaster of Paris with common plaster to make it set quickly. The result is called gauged mortar. (arch.)

(2) A tool used by carpenters in order to strike a line parallel to the edge of a board.

(3) Any measuring instrument. A pressure gauge.

gage cock (P.P.)

A valve attached to a water column or drum for checking water level.

gage glass (P.P.)

The transparent part of a water gage assembly connected directly or through a water column to the boiler, below and above the water line, to indicate the water level in the boiler.

gage pressure

The pressure above atmospheric pressure.

gain (arch.)

A beveled shoulder on the end of a mortised brace, for the purpose of giving additional resistance to the shoulder.

galvanize

To coat a metal with zinc in order to prevent rusting.

galvanized nails
Zinc-coated nails for use in objects that will be exposed to weather.

galvanometer (elect.)
An instrument used to measure small electrical currents.

gambrel roof (arch.)
A roof with two pitches, similar to a Mansard or curb roof.

garret
See attic.

gas analysis
The determination of the constituents of a gaseous mixture.

gas burner
A burner for use with gaseous fuel.

gas cyaniding (heat treat)
A misnomer for carbonitriding.

gas house tar
By-product from the distillation of coal for illuminating gas.

gasification
The process of converting solid or liquid fuel into a gaseous fuel—such as the gasification of coal.

gasket
Packing, of any material, placed between two metal or similar surfaces that are to be drawn together in a watertight or airtight joint.

gate valve
A valve in which the flow of water is cut off by means of a circular disk, fitting against machine-smoothed faces, at right angles to the direction of flow. The disk is raised or

lowered by means of a threaded stem connected to the handle of the valve. The opening in the valve is usually as large as the full bore of the pipe.

gear cutting

The process of cutting gear teeth. This is done on a special gear cutting machine or milling machine with a gear cutter or hob.

generating tube (P.P.)

A tube in which steam is generated.

generator (elect.)

A machine that converts mechanical energy into electrical energy.

geometric addition—vector addition (E.M.)

The addition of quantities considering both their magnitude and direction.

ghost point (P.P.)

A term used in boiler water testing with soap solution. A lather appears to form but will disappear upon the addition of more soap solution. This point represents total calcium hardness and the final lather total hardness.

girder (arch.)

A large timber or iron beam, either single or built-up, used to support concentrated loads at particular points along its length. Used to support either joists or walls over an opening.

girth superheater (P.P.)

A superheater of a horizontal return tubular boiler in which the superheater elements are wrapped partially around the shell.

glass blocks (arch.)

Translucent or transparent blocks of glass used in building.

glazed bricks
Bricks with a glazed surface.

glazing (arch.)
The process of putting a pane of window glass into a sash.

globe valve
A valve in which the flow of water is cut off by means of a circular disk that fits against the valve seat. The plane of movement of the disk is parallel to the normal direction of flow of water, which is turned through a tortuous passage to direct the flow normal to the face of the disk.

gooseneck (P.P.)
A return bend of small-sized pipe one end of which is about 1 ft. long and the other about 3 in. long. It is commonly used as a faucet for a pantry sink. Also, the lead connection between a service pipe and a water main.

grade (arch.)
The slope or pitch of the ground. As distinct from the natural grade, the established grade is the level of the street curb as fixed by the municipality.

grade (F.&C.)
Coal classification according to quality.

grading (arch.)
Modifying the ground surface by filling, cutting, or both.

grain (arch.)
(1) The lines in wood;
(2) The appearance, direction, size, arrangement or quality of the fibers in wood.

grains per cu. ft.
The term for expressing dust loading in weight per unit of gas volume (7000 grains equals one pound).

granular ash
Small particles of dry ash.

graphitizing (heat treat)
Annealing a ferrous alloy in such a way that some or all of the carbon is precipitated as graphite.

grate (F.&C.)
The surface on which fuel is supported and burned, and through which air is passed for combustion.

grate bars (F.&C.)
Those parts of the fuel supporting surface arranged to admit air for combustion.

gravel
Small stones used in making concrete or used as fill.

gravity (E.M.)
Gravity is that net force that causes a body in equilibrium to accelerate towards the earth's center.

gravity (F.&C.)
Weight index of fuels: liquid petroleum products expressed either as specific, Baume, or A.P.I. (American Petroleum Institute) gravity; weight index of gaseous fuels as specific gravity related to air under specified conditions; or weight index of solid fuels as specific gravity related to water under specified conditions.

green lumber
Lumber that has not been properly seasoned.

grid (elect.)
A metal wire mesh placed between the cathode and plate.

grid battery (elect.)
The battery used to supply the desired potential to the grid.

grid leak (elect.)

A very high resistance placed in parallel with the grid condenser.

grille (arch.)

Iron-work in the form of an enclosure screen. Grilles are made of wrought iron, ornamented by the swage and punch, and put together by either rivets or clips. They are used extensively to protect the lower windows in city houses and to protect the glass of outside doors.

grindability (F.&C.)

Grindability is the characteristic of coal representing its ease of pulverizing and is one of the factors used in determining the capacity of a pulverizer. The index is relative, the larger values, such as 100, represent coals easy to pulverize like Pocahontas and smaller values such as 40 represent coals difficult to pulverize.

grinding

Reducing to size by removing material by contact with a rotating, abrasive wheel. Plane and cylindrical surfaces may be very accurately and smoothly finished with regard to size and shape. Hardened cutting tools are sharpened by grinding.

groove (arch.)

In joinery, a term used to signify a sunk channel whose section is rectangular. It is usually used on the edge of a molding, stile, or rail, etc. into which a tongue corresponding to its section, and in the substance of the wood to which it is joined, is inserted.

grooved tube-seat (P.P.)

A tube seat having one or more shall grooves into which the tube may be forced by the expander.

ground (elect.)

A connection made directly to the earth or to a frame or structure which serves as one line of a circuit.

ground floor (arch.)
That floor of a building which is level, or nearly so, with the ground.

ground joint
A machined metal joint that fits tightly without gasket or packing.

ground joist
A joist that is blocked up from the ground.

ground-key valve (P.P.)
A valve or faucet through which the rate of flow of water is controlled by means of a circular plug or key that fits closely in a cylindrical or conical machine-ground seat. The plug has a hole bored through it as a waterway. When the hole is in line with the run the valve is open; when turned at right angles to the run, the valve is closed.

ground water
Water that is standing in or passing through the ground.

grounds
Pieces of wood embedded in the plastering of walls to which skirting and other joiner's work is attached; also used to stop the plastering around door and window openings.

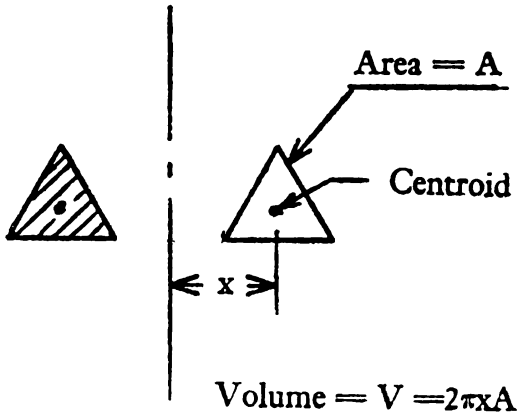
group (F.&C.)
A sub-classification of coal by rank.

group vent (P.P.)
A branch vent that performs its function for two or more traps.

grout (arch.)
A thin cement mortar used for pointing. It is made so thin by the addition of water that it will run into all the joints and cavities of the masonwork and fill it up solid.

Guldinus' theorem (E.M.)

A theorem by which the volume of rotation of an area about a non-intersecting axis can be found. The volume is the product of the area of the figure and the length of the path from the axis of revolution to the centroid of the area.



gutter

Channel for carrying off rain water.

guy

A rope, chain, or rod attached to an object to steady it.

guyed steel stack (P.P.)

A steel stack of insufficient strength to be self-supporting which is laterally stayed by guys.

gyroscope (E.M.)

A rotating wheel able to rotate about two non-parallel axes. It is used as a stabilizer. Any unbalance tending to alter the plane of spin of the gyroscope, causes it to turn about an axis perpendicular to that of the unbalance so that the gyroscope always maintains a fixed axis of rotation. This effect is known as precession.

H

hairpin tube (P.P.)
A tube bent to the shape of a hair pin.

hall
A room or passageway at the entrance to a house or to a group of rooms.

halving (arch.)
The joining of two pieces of timber by letting one into the other.

hand fired grate (F.&C.)
A grate on which fuel is placed manually, usually by means of a shovel.

hand lance (P.P.)
A manually manipulated length of pipe carrying air, steam, or water for blowing ash and slag accumulations from heat absorbing surfaces.

handhole (P.P.)
An opening in a pressure part for access, usually not exceeding 6″ in longest dimension.

handhole cover (P.P.)
A handhole closure.

hanger (arch.)
An iron support used for attaching beams.

hanging style (arch.)
That part of a door to which the hinges are attached.

hard-surfacing electrodes (weld.)
Electrodes which produce a weld metal to resist either wear, abrasion or impact.

hard water
Water which contains calcium or magnesium in an amount which require an excessive amount of soap to form a lather.

hardboard
See composition board.

hardenability (heat treat)
In a ferrous alloy, the property that determines the depth and distribution of hardness induced by quenching.

hardening (heat treat)
Increasing the hardness by suitable treatment, usually involving heating and cooling. When applicable, the following more specific terms should be used: age hardening, case hardening, flame hardening, induction hardening, precipitation hardening, and quench hardening.

hardness (P.P.)
A measure of the amount of calcium and magnesium salts in a boiler water. Usually expressed as grains per gallon or p.p.m. as $CaCO_2$.

hardwood floors
Floors made out of hardwoods, such as oak and maple.

hatchet iron
A special form of soldering iron.

hatching (arch.)
Drawing parallel lines close together for the purpose of indicating a section of anything. The lines are usually drawn at an angle of 45° with a horizontal.

head (arch.)
The top portion of a door or window opening.

header (P.P.)
A pipe of many outlets. The outlets are parallel and are frequently at 90° to the center line of the header. See also manifold.

header (arch.)
A beam placed perpendicular to joists and to which joists are nailed in framing for a chimney, stairway, or other opening. More generally, a piece or member that makes a T-joint with other members; often a short piece extending between other members and at right angles to them; often used instead of lintel.

headers (arch.)
In masonry, stones or bricks extending over the thickness of a wall.

heading courses (arch.)
Courses of a wall in which the stones or bricks are all headers.

headway (arch.)
Clear space or height under an arch or over a stairway, and the like.

hearth
That portion of a fireplace which extends into the room.

heartwood (arch.)
The inner, dead portion of the wood in a tree. It is usually dark in color. In trees like white spruce, hemlock, white fir, basswood, and holly, the heartwood is not distinctly darker than the sapwood, and the two can not be readily distinguished.

heat available (P.P.)

The thermal energy above a fixed datum that is capable of being absorbed for useful work. In boiler practice, the heat available in a furnace is usually taken to be the higher heating value of the fuel corrected by subtracting radiation losses, unburned combustible, latent heat of the water in the fuel or formed by the burning of hydrogen, and adding the sensible heat in the air for combustion, all above ambient temperatures.

heat balance

An accounting of the distribution of the heat input and output.

heat exchanger (P.P.)

A vessel in which heat is transferred from one medium to another.

heat release

The total quantity of thermal energy above a fixed datum introduced into a furnace by the fuel, considered to be the product of the hourly fuel rate and its high heat value, expressed in Btu per hour per cubic foot of furnace volume.

heat treating

Carefully controlled heating and cooling of steel to bring it to its highest efficiency.

heat-treatment

Heating and cooling a solid metal or alloy in such a way as to obtain desired conditions or properties. Heating for the sole purpose of hot working is excluded from the meaning of this definition.

heating surface

The surface which is exposed to the heating medium for absorption and transfer of heat to the heated medium.

heavily covered electrodes (weld.)
Electrodes which have a relatively thick covering material serving the dual purpose of stabilizing the arc and improving the properties of the weld metal. Extrusion, wrapping, dipping, or combinations of these or other means are included in this classification.

heel
End cut on a rafter. The foot of the rafter that rests on the wall plate.

held (arch.)
A beam or plate supported in such a manner which permits it to rotate in the plane of bending but prevents motion of the edges of the neutral surface.

herringbone work
Bricks, tiles, or other materials arranged diagonally in building.

high-heat value
See calorific value.

high-tensile electrodes
Steel electrodes whose alloys are added to give tensile strength above 75,000 pounds per square inch in weld metal.

high-velocity thermocouple
A single-shielded furnace gas temperature measuring instrument arranged so that furnace gases are drawn over the junction of the thermocouple at high velocities.

hip rafter
A rafter that forms the intersection of an external roof angle.

hips (arch.)
Those pieces of timber placed in an inclined position at the corners or angles of a hip roof.

hog (F.&.C.)
A machine for reducing wood refuse to chips or shreds of approximately uniform size.

hogged fuel (F.&.C.)
Wood refuse after being chipped or shredded by a machine known as a "hog."

homogenizing (heat treat)
Holding at high temperature to eliminate or decrease chemical segregation by diffusion.

honeycombing (arch.)
In the case of wood, checks that occur in the interior of a piece, often not visible at the surface. On a cross-section they usually appear as slits or pockets the width of which may be very large relative to the radial length.

hood-mold (arch.)
The drip-stone or label over a window or door opening, whether inside or out.

Hooke's Law (E.M.)
"*Ut tensio sic vis.*"
Hooke's law states that the force applied to a system is proportional to the deformation of the system. When applied to a simple helical spring, the law can be written:

$$P = KS$$

P = force in pounds
K = proportionality constant or spring modulus
S = deformation in inches

hopper (P.P.)
A chamber or bin used for holding solid fuel or refuse.

hopper bottom furnace
A furnace bottom with one or more inclined sides forming a hopper for the collection of ash and for the easy removal of same.

hopper valley angle (P.P.)
The angle formed by the intersection of adjacent sides of a hopper with the vertical—usually 45 deg. for fly ash.

horizontal
Parallel to the earth's surface when we consider the earth's surface a flat plane.

horizontal branch (P.P.)
A branch drain extending laterally from a soil or waste stack, with or without vertical sections or branches, that receives the discharge from one or more fixture drains and conducts it to the soil or waste stack or to the building drain.

horizontal firing (F.&.C.)
A means of firing liquid, gaseous or pulverized fuel, in which the burners are so arranged in relation to furnace as to discharge the fuel and air into the furnace in approximately a horizontal direction.

horizontal pipe
A pipe or fitting that is installed in a horizontal position or that makes an angle of 30° or less with the horizontal.

horizontal return-tubular boiler (HRT)
See boiler.

horsepower: or HP
This term is a result of experiments by James Watt who was looking for a means of expressing the power of steam engines. It is said that he actually experimented with horses and discovered that they were capable of producing an average effort of 500 foot pounds per second. This term has become standard and is used as a work factor for rating prime movers. Thus one horsepower is equivalent to 550 ft. lbs. per second and a 100 hp engine operating at full capacity will deliver 55,000 foot pounds of energy every second it runs. (See power.)

horsepower-hour

A rate of expending power. One horsepower hour is equal to the work done when one horsepower of work is delivered for one hour.

hot quenching (heat treat)

Quenching in a medium at an elevated temperature.

hot wire (elect.)

An electric wire through which a current is passing; a live wire.

house drain

That part of the lowest horizontal piping of a plumbing system which receives the discharge from soil, waste, and other drainage pipes inside of a building and conveys it to the house sewer. Same as "building drain."

house sewer

That part of the horizontal piping of a plumbing system extending from a point about 4 or 5 ft. from the inner face of the foundation wall of a building to the junction with another sewer or to any point of discharge, and conveying the drainage of but one building site. Also, a "building sewer."

house slant (arch.)

A tee or wye connection in a sewer for the purpose of receiving the house sewer.

housing (arch.)

(1) The space made in one solid to permit the insertion of another.

(2) The base on a stair is generally housed into the treads and risers.

(3) A metal covering for a mechanism.

hub

The bell end or enlarged end of a cast-iron or vitrified-clay pipe. Same as "bell."

hub and groove diameter

The outside diameter of the hub, or the diameter at the base of a groove cut in the hub to provide clearance for the link plates of a chain.

hydrant

A valve or faucet for drawing water from a pipe. The term is usually applied to an outside installation for supplying a relatively large quantity of water for sprinkling, watering, fire protection, and similar purposes.

hydrocarbon

A chemical compound of hydrogen and carbon.

hydrokineter

A device for recirculating or causing flow of water by the use of a jet of steam or water at higher pressure than the water caused to flow.

hydrostatic test

A strength and tightness test of a closed pressure vessel by water pressure.

hysteresis (A.C.)

The difference between the increasing input value and the decreasing input value which effect the same output value. This term applies only where the output value is a continuous function of the input value.

I

I-beam
A steel structural member rolled to the shape of the letter "I".

ignition (F.&.C.)
The initiation of combustion.

ignition arch (F.&.C.)
A refractory arch, or surface, located over a fuel bed to radiate heat and increase the rapidity of ignition.

ignition temperature
Lowest temperature of a fuel at which combustion becomes self-sustaining.

ignition torch (F.&.C.)
See "lighting-off torch."

illuminants (F.&.C.)
Light oil or coal compounds that readily burn with a luminous flame such as ethylene, propylene and benzene.

impact
See elastic impact.

impact plate (F.&.C.)
A plate against which a stream of coal is impinged for the purpose of pulverization.

impeller (F.&.C.)
As applied to pulverized coal burners, a round metal device located at the discharge of the coal nozzle in circular type burners, to deflect the fuel and primary air into the

secondary air stream. As applied to oil burners, same as diffuser.

impingement (P.P.)
The striking of moving matter, such as the flow of steam, water, gas or solids, against similar or other matter.

impulse (E.M.)
The name given to the product of force and time. If the force is a variable, the impulse is calculated by the integral of the force and the time interval that the force acts on a body. Hence;

$$\text{Impulse of Force} = \int F\partial t$$

(Also see momentum, impulse and momentum theory.)

impulse and momentum theory (E.M.)
Is a fundamental theory of mechanics which states, "the change in momentum of a body is equal to the force of impulse exerted upon that body." The theory is expressed mathematically by:

$$\int F\partial t = \int m\partial v$$

inches water gage ("w.g.")
Usual term for expressing a measurement of relatively low pressures or differentials by means of a U-tube. One inch w.g. equals 5.2 lb. per sq. ft. or 0.036 lb. per sq. in.

incipient decay (arch.)
In the case of wood, the early stage of decay which has not proceeded far enough to soften or otherwise perceptibly impair the hardness of the wood. It is usually accompanied by a slight discoloration or bleaching of the wood as instanced by the "firm red heart" in softwoods and the "water-soak" stage in certain types of decay.

incise
To cut in, carve, or engrave.

included angle (E.M.)
For silent chains, the angle included between the outer surfaces of the link plate contours. This angle affects the layout of the sprocket tooth form.

incomplete combustion
The partial oxidation of the combustible constituents of a fuel.

increaser (P.P.)
A coupling with one end larger than the other. Sometimes, more specifically, a pipe fitting to join the end of a small coupling with inside threads to the end of a larger pipe with outside threads. The reverse of a "decreaser."

indented (em.)
Toothed together.

indirect cross connection (P.P.)
A potential cross connection such that the interconnection is not continuously enclosed and the completion of the cross connection depends on the occurrence of one or more abnormal conditions.

indirect waste pipe (P.P.)
A waste pipe that does not connect directly with the building drainage system but discharges into it through a properly trapped fixture or receptacle.

individual vent (P.P.)
See back vent.

induce (elect.)
To produce an effect in a body by exposing it to the influence of a magnetic force, an electric force, or a changing current.

induced draft fan (P.P.)
A fan exhausting hot gases from the heat absorbing equipment.

induction coil (elect.)
Two coils so arranged that an interrupted current in the first produces a voltage in the second.

induction heating
Heating by electrical induction.

inert gaseous constituents
Incombustible gases such as nitrogen which may be present in a fuel.

inertial force (em.)
See D'Alembert's Principle.

influence line (em.)
A curve drawn to show the bending moment, vertical shear, or deflection at a particular section of a beam produced by a unit load applied at that section.

inherent moisture (F.&.C.)
Sometimes called the bed moisture, is moisture so closely held by the coal substance that it does not produce wetness.

inhibitor (P.P.)
A substance which selectively retards a chemical action. An example in boiler work is the use of an inhibitor, when using acid to remove scale, to prevent the acid from attacking the boiler metal.

initial deformation (P.P.)
The temperature at which a standard ash cone exhibits the first signs of rounding or bending of the apex when heated in accordance with a prescribed procedure.

injector (P.P.)
A device utilizing a steam jet to entrain and deliver feed water into a boiler.

inlaying (arch.)

Inserting pieces of ivory, metal, or choice woods, or the like, into a groundwork of some other material, for the purpose of ornamentation.

inlet boxes (P.P.)

An integral part of the fan enclosing the fan inlet or inlets to permit attachment of the fan to the duct system.

inspecting

Checking parts and units at various stages of production. The tool designer is required to make gages of various types for inspection purposes. The study of tolerances and limits is especially important in this connection.

inspection door (P.P.)

A small door in the outer enclosure so that certain parts of the interior of the apparatus may be observed.

instant center (E.M.)

That point or points in a body having plane motion about which the body rotates for an instant and has zero velocity. Usually called the instantaneous center of rotation.

insulate

Generally speaking, to insulate means to detach, separate, or isolate; the word has several applications:

(1) to equip a building with materials that will prevent the passage of heat, cold, or sound.
(2) to cover electric wires with materials that will prevent the passage of electricity.
(3) to devise a system for preventing the entrance of termites, mice, and other annoying rodents and insects into a building.
(4) detached from another building; or standing free from the wall.

insulation
A material of low thermal conductivity used to reduce heat losses.

interbank superheater (P.P.)
A superheater located in a space between tube banks of a bent tube boiler.

integral action (A.C.)
Is that in which the final control element is positioned in accordance with a time integral function of the controlled variable. Floating action is the most common form of integral action.

integral blower
A blower built as an integral part of a device to supply air thereto.

integral-blower burner (P.P.)
A burner of which the blower is an integral part.

integral economizer (P.P.)
A segregated portion of a water tube boiler in which the feed water is preheated before its admixture with the circulating boiler water.

interceptor (P.P.)
A receptacle designed and constructed to intercept or separate, and prevent the passage of oil, grease, sand, or other materials into the drainage system to which it is directly or indirectly connected.

intercom knot (arch.)
A knot whose rings of annual growth are completely intergrown with those of the surrounding wood.

interconnection (P.P.)
A cross connection. Not to be confused with a "cross-over."

interdeck superheater (P.P.)
A superheater located in a space between the tube banks of a straight tube boiler.

interior (arch.)
The inside of a house or other building.

interlocked-grained wood (arch.)
Wood in which the fibers are inclined in one direction in a number of rings of annual growth, then gradually reverse and are inclined in an opposite direction in succeeding growth rings, then later again reverse, etc.

intermediate annealing (heat treat)
Annealing wrought metals at one or more stages during manufacture and before final thermal treatment.

intermittent blowdown (P.P.)
The blowing down of boiler water at intervals.

intermittent firing (F.&.C.)
A method of firing by which fuel and air are introduced into and burned in a furnace for a short period, after which the flow is stopped, this succession in a sequence of frequent cycles.

internal diameter (E.M.)
The diameter of a circle coinciding with the tops of the teeth of an internal gear.

internal furnace
A furnace within a boiler consisting of a straight or corrugated flue, or a fire-box substantially surrounded with water cooled heating surface except the bottom.

internal-mix oil burner
A burner having a mixing chamber in which high velocity steam or air impinges on jets of incoming liquid fuel which is then discharged in a completely atomized form.

internal stress (E.M.)
The stress set up within a structural member when acted upon by an external force.

internal treatment (P.P.)
The treatment of boiler water by introducing chemicals directly into the boiler.

internally fired boiler
A fire tube boiler having an internal furnace such as a Scotch, Locomotive Fire-Box, Vertical Tubular, or other type having a water-cooled plate-type furnace.

interrupted aging (heat treat)
Aging at two or more temperatures, by steps, and cooling to room temperature after each step. See aging and compare with progressive aging.

interrupted quenching (heat treat)
Quenching in which the metal object being quenched is removed from the quenching medium while the object is at a temperature substantially higher than that of the quenching medium. See also time quenching.

interrupter (elect.)
A device for the automatic making and breaking of an electrical circuit.

intertube burner (F.&C.)
A burner which terminates in nozzles discharging between adjacent tubes.

intertube economizer (P.P.)
An economizer, the elements of which are located between tubes of a boiler convection bank.

intertube superheater (P.P.)
A superheater, the elements of which are located between tubes of a boiler convection bank.

inversely
Reversed in position.

invert (P.P.)
The lowest portion of the inside of any pipe or conduit that is not vertical.

inverted joint (P.P.)
A fitting reversed in position, upside down, or turned in a contrary direction.

inverted-loop tube (P.P.)
A substantially vertical U bend element, which is suspended so that the U bend is at the top.

ion (elect.)
An electrically charged atom.

iso-clinic
A line on which the principle stresses in a stressed body have the same direction.

isogenic line
An imaginary line drawn through points on the earth's surface where the magnetic deviation is equal.

isothermal annealing (heat treat)
Austenitizing a ferrous alloy and then cooling to and holding at a temperature at which austenite transforms to a relatively soft ferrite-carbide aggregate.

isothermal transformation
A change in phase at any constant temperature.

isotropic
When a member has the same physical properties in all planes, it is called isotropic.

J

jack
See Jackscrew.

jack rafter (arch.)
A short rafter, used especially in hip roofs. It spans the distance from a wall plate to a hip or from a valley to a ridge.

jackscrew or jack
A mechanical device, usually portable, used for raising large weights thru short distances by hand power. The mechanical advantage of the jack, obtained by screw, lever, or hydraulic action allows the operator to raise a weight many times than would be possible unaided by the jack.

jamb (arch.)
The side post or lining of a doorway or other opening. The jambs of a window outside the frame are called reveals.

jamb shafts (arch.)
Small shafts to doors and windows with caps and bases. When in the inside arris of the jamb of a window, they are sometimes called esconsons.

jet propulsion
The projection of a vehicle by expelling a jet of substance from the propelled agent is called jet propulsion.

joggle (arch.)
A joint between two bodies which is so constructed by

means of jogs or notches as to prevent their sliding past one another.

Johnson's apparent elastic limit
See apparent elastic limit.

joiner
A V-shaped steel implement used to tool mortar in order to compress it and make a waterproof joint.

joinery
That branch of building which is confined to the finer and more ornamental parts of carpentry.

joint
To fit two pieces of material together; the point at which two pieces of material are joined to one another.

jointer
Any of various tools used in making joints.

joint runner
An incombustible type of packing usually used for holding lead in the bell in the pouring of lead joints.

joist
A small timber to which the boards of a floor or the lathe of a ceiling are nailed; one of a series of parallel beams, supported in turn by larger beams, girders, or bearing walls.

joist hanger
A metal strap used to suspend floor joists.

joule
A unit of energy or work. A joule of energy is liberated by one ampere flowing for one second through a resistance of one ohm. One foot pound is equivalent to 1.35582 joules.

journeyman plumber
A plumber who does plumbing work for another for hire.

jumper tube

A short tube connection for by-passing, routing, or directing the flow of fluid as desired.

jumpover

See "return offset."

K

key cap
See Cup Cap.

keyhole saw
A keyhole saw resembles a compass saw but has an even more narrow and tapering blade. It is designed for cutting out keyholes.

keystone
The stone placed in the center of the top of an arch.

kiln-dried
Term used to describe material that has been seasoned in a kiln oven rather than in the air.

kiln-dried wood
Wood dried in a kiln to speed up the usual air drying or seasoning process.

kilo
A prefix meaning thousand: as kilograms, or kilowatts.

kilowatt
A unit of energy in the meter, kilogram, second (mks) system is one joule per second which is called a watt. 1000 watts is called a kilowatt.

kilowatt-hour
Is a rate of expanding power. One kilowatt-hour is equal to the work done when one kilowatt of work is delivered for one hour.

kinematics

The science of abstract motion without regard to the cause of motion.

kinetic energy

The energy of motion. The usual equation for kinetic energy evaluates the instantaneous value of energy of a moving body. For a translating body, it is written

$$KE = \tfrac{1}{2}MV^2$$

where M = Mass of the Body
V = Velocity of the Body

for a rotating body

$$KE = \tfrac{1}{2}IW^2$$

where I = Moment of Inertia
W = Rotative Speed of the Body

kinetics

The science that deals with the relationship of force, mass, and acceleration.

kingpost

The middle post of a trussed piece of framing, for supporting the tie-beam at the middle and the lower ends of the struts.

knee (arch.)

A piece of timber naturally or artificially bent to receive another in order to relieve a weight or strain.

knot (arch.)

In the case of wood, that portion of a branch which has become incorporated in the body of a tree.

knuckles of a hinge

The rounded portion of a hinge plate that takes the hinge pin.

lag (elect.)
The number of degrees an alternating current lags behind voltage.

lag (A.C.)
The time delay of an instrument in the indication of a measured quantity.

lag screws
Heavy wood screws used on timbers and heavy beams.

lagging
A covering, usually of insulating material, on pipe or ducts.

laminations
The thin sheets or discs making up an iron core.

lance door (P.P.)
A door through which a hand lance may be inserted for cleaning heating surfaces.

land (em.)
The TOP LAND is the top surface of a tooth, and the BOTTOM LAND is the surface of the gear between the flanks of adjacent teeth.

landing (arch.)
A platform in a flight of stairs between two stories, or at the termination of a stairway.

lap joint
A joint formed by lapping the edge of one piece of material over the edge of another.

lap siding
See bevel siding.

lap weld
A weld in which two metallic surfaces are connected by lapping one over the top of the other. Frequently used in making small-sized iron pipe from sheet metal.

large knot (arch.)
A knot more than 1½″ in diameter.

lashing
Several turns of rope around a timber beam or similar object and used for binding.

lateral
In plumbing, a secondary pipe line. In sewerage, a common sewer to which no other common sewer is tributary. It receives sewage only from building sewers.

lathe turning
Removing material from revolving work by using suitably formed cutting tools of hardened and tempered steel or of alloy metals such as carbloy, stellite, etc. Numerous production operations such as thread cutting (internal and external), knurling, cutting tapers, etc., are performed on the lathe.

laths
Thin strips of wood four feet long, nailed to studding as supports for plaster. Also, wire-mesh or composition plasterboard.

latrine
A water closet consisting of a continuous trough containing water. The trough extends under two or more adjacent seats. Prohibited by most health authorities for permanent installations.

lattice

(1) Any work of wood or metal that is made by crossing laths, rods, or bars to form a network.

(2) A reticulated window, made of laths or slips of iron separated by glass windows. These are used only where air rather than light is to be admitted.

lavatory

A fixture designed for the washing of the hands or face. Sometimes called a "wash basin."

lay (arch.)

Refers to the direction of twist of a rope.

leaching cesspool

A cesspool that is not watertight.

lead (pronounced led) (em.)

The lead of a screw is the distance that a screw will advance axially in one revolution.

lead burning (P.P.)

Welding lead.

lead tacks

Pieces of lead that are soldered to lead pipe so that it can be attached to a support.

lead wool

Shredded lead. Used frequently in packing lead joints, often in wet places.

leader

The pipe from the gutter to the ground; a downspout.

leakage

The uncontrolled quantity of fluid which enters or leaves through the enclosure of air or gas passages.

lean-to
A small building whose rafters pitch or lean against another building or against a wall.

least count (A.C.)
The smallest graduation of an instrument.

ledge or ledgement
A projection from a plane, as slips on the sides of window and door frames to hold them steady in their places.

ledge plate (F.&.C.)
A form of plate which is adjacent to, or overlaps, the edge of a stoker.

ledgers (arch.)
The horizontal pieces that are fastened to the standard poles or timbers of scaffolding raised around buildings during their erection. Those which rest on the ledgers are called putlogs, and the boards are laid on these.

ledger strip (arch.)
A strip of lumber nailed along the bottom of the side of a girder on which joists rest.

length (P.P.)
That dimension measured between the cut ends. (q.v.) A length of pipe.

length of pipe
The length as measured along the center line. A standard length of steel pipe is 21 feet.

leyden jar (elect.)
An early form of electrical condenser.

liberation
See "heat release."

ligament (P.P.)

The minimum cross section of solid metal in a header, shell or tube sheet between two adjacent holes.

light (arch.)

(1) A division or space in a sash for a single pane of glass.

(2) A pane of glass.

lighting-off torch (F.&.C.)

A torch used for igniting fuel from a burner. The torch may consist of asbestos wrapped around an iron rod and saturated with oil or may be a small oil or gas burner.

lightly coated electrodes (weld)

Electrodes with a thin coating designed to control welding characteristics. These are divided into two classes which are as follows:

(1) Electrodes (formerly known as bare electrodes) with a coating applied either during or prior to the drawing operation.

(2) Electrodes with coatings applied after the drawing process. Included herein are washed, sprayed, brushed, tumbled, dipped or otherwise made light coatings.

lignite (F.&.C.)

A consolidated coal of low classification according to rank—moist (bed moisture only) Btu less than 8300.

line

Any portion of a rope used to reeve tackle between the source of power and the blocks (fall line), between blocks (return line or return), or between blocks and the anchorage (dead line).

line of action (E.M.)

That portion of the common tangent to the base circles along which contact between mating involute gear teeth occurs.

line of force
A line in a field of force that shows the direction of the force.

linear
Pertaining to a line as linear displacement or linear motion.

lining (P.P.)
The material used on the furnace side of furnace wall. It is usually of high grade refractory tile or brick or plastic refractory material.

lining (arch.)
(1) Covering for the interior, as casing is covered for the exterior, surface of a building.
(2) Linings for doors, windows, shutters, etc.

link (E.M.)
An element of chain.

link plate (E.M.)
One of the side plates of either a pin link or a roller link in a roller chain. For a silent chain, any one of the plates of which an assembled chain is composed.

lintel (arch.)
The horizontal pieces which covers the opening of a door or window and supports the load over it.

liquid-ash removal (P.P.)
The method of intermittently or continuously drawing off ash in a molten condition from the bottom of a furnace.

liquid slag (P.P)
Slag in a fluid state.

live steam
Steam which has not performed any of the work for which it was generated.

live-steam reheater
A heat exchanger of the shell and tube type, for reheating steam between expansion stages of a prime mover or between prime movers at different pressures, using steam at substantially boiler pressure.

load
The rate of output; also the weight carried.

load (elect.)
The energy delivered by a generator to its circuit.

load-bearing wall
See wall, bearing.

load-bearing tile
Tile for use as load-bearing structural units in masonry walls.

load classification
A classification of drive loads based on the intensity of the shock that is imposed on the drive.

load factor
The ratio of the average load in a given period to the maximum load carried during that period.

load range (P.P.)
Range of boiler load with corresponding gas volumes and velocities through which efficiency of the dust collector meets requirements.

local vent
A pipe or shaft serving to convey foul air from a plumbing fixture or a room to the outer air.

lock nut
A nut that is screwed up tightly against another nut to prevent it from becoming loosened.

lodestone
A piece of magnetite.

long flame burner (F.&C.)

A burner in which the fuel emerges in such a condition, or one in which the air for combustion is admitted in such a manner, that the two do not readily mix, resulting in a comparatively long flame.

long screw

A nipple 6 in. long with one thread much longer than the ordinary thread.

longitudinal-drum boiler

See boiler.

lookout (arch.)

A short wood bracket or cantilever which supports an overhanging portion of a roof or the like, usually concealed from view.

loop

Similar to bight except that the two portions lie alongside each other.

loop or circuit vent (P.P.)

A continuation of a horizontal soil or waste pipe beyond the connection at which liquid wastes from a fixture or fixtures enter the waste or soil pipe. The extension is usually vertical immediately beyond its connection to the soil or waste pipe. The base of the vertical portion of the vent may be connected to the horizontal portion of the soil or waste stack between fixtures connected thereto. The Plumbing Manual* and the Housing Code** differentiate between a circuit vent and a loop vent in that the loop vent "loops back and connects with a soil- or waste-stack vent instead of the vent stack."

---

*"Plumbing Manual," Report BMS66, Subcommittee on Plumbing, National Bureau of Standards, 1940.

** "The Uniform Plumbing Code for Housing," Housing and Home Finance Agency, February, 1948.

loose knot (arch.)
A knot not firmly held in place by growth or position.

lot (arch.)
A subdivision of a block, or another portion of land that is considered as a unit of property and is described by metes and bounds. If one or more lots are built upon as a single unit of property, they are considered as a single lot.

louver (arch.)
A kind of vertical window, frequently in the peaks of gables and in the tops of towers. It is equipped with horizontal slats which permit ventilation and exclude rain, but does not have glass panes.

low-heat value—lower heating value
The high heating value minus the latent heat of vaporization of the water formed by burning the hydrogen in the fuel.

lower heating value
See low-heat value.

Lüders lines—slip lines (E.M.)
The lines which appear on a crystalline body which has been polished and stressed beyond the elastic limit are called slip or Lüders lines.

lug
Any projection, like an ear, used for supporting or grasping.

lugs
Projections at the ends of door stiles.

luminosity
Emissive power with respect to visible radiation.

M

machining
Performing various operations by machines on metal. Since the tool designer is constantly and directly concerned with machine shop operations, they will be discussed more fully in subsequent paragraphs.

magnetic circuit
The complete path followed by magnetic lines of force.

magnetic flux
The total number of lines of force issuing from a pole.

magneto
A generator in which the field is supplied by a permanent magnet.

magnetite
An iron ore that is magnetic.

magnification factor (em.)
In a body undergoing a forced vibration, it is the factor by which the zero frequency deflection must be multiplied to determine the amplitude. Hence it is the ratio of the amplitude to the zero frequency deflection.

main vent
Same as "vent stack."

make-up (P.P.)
The water added to boiler feed to compensate for that lost through exhaust, blowdown, leakage, etc. As make-up water.

male thread

A thread on the outside of a pipe or fitting. Preferably called an "outside thread."

malleable iron

Cast iron that has been specially heat-treated to render it less brittle than ordinary cast iron.

malleablizing (heat treat)

Annealing white cast iron in such a way that some or all of the combined carbon is transformed to graphite or, in some instances, part of the carbon is removed completely.

manhead (P.P.)

The head of a boiler drum or other pressure vessel having a manhole.

manhole

(1) An opening constructed in a sewer or any part of a plumbing system of sufficient size for a man to gain access thereto.

(2) An opening in a pressure vessel of sufficient size to permit a man to enter.

manifold

A pipe or header for collecting a fluid from, or the distributing of a fluid to a number of pipes or tubes. See also "header."

manipulated variable (A.C.)

Is that quantity or condition which is varied by the automatic controller so as to affect the value of the controlled variable.

mansard roof

See curb roof.

mantel

The work over a fireplace in front of a chimney. It usually consists of an ornamented shelf above the fireplace.

manual welding

Manual welding is welding wherein the arc is controlled or the torch is manipulated by hand.

manufactured gas

Fuel gas manufactured from coal, oil, etc. as differentiated from natural gas.

margin of safety

The margin by which a design exceeds the rupture point. When used as an aeronautical term, it is the percentage by which the ultimate strength exceeds the *design load*. The design load is specified as the maximum probable load multiplied by a factor of safety.

martempering (heat treat)

Quenching an austenitized ferrous alloy in a medium at a temperature in the upper part of the martensite range, or slightly above that range, and holding in the medium until the temperature throughout the alloy is substantially uniform. The alloy is then allowed to cool in air through the martensite range.

masking tape

A tape with an adhesive on one side, used for painting and decorating. The tape can be removed without damage to a painted surface.

masonry

Brick, stone, tile, or terra-cotta laid in mortar or concrete.

masonry block

A building block of concrete or cinder, usually 7⅝ x 7⅝ x 15⅝. Different sizes are used for footings and partition walls.

mass

Mass is that property of a body which gives the body inertia. Therefore we can say that mass is the quantitative measure of inertia.

mass blower (P.P.)
A single or multi-jet soot blower with a large nozzle area for discharging a relatively large volume of the blowing medium in a short time.

master plumber
A person with knowledge of and experience in plumbing who employs journeymen plumbers or who conducts a plumbing business.

mastic
A type of composition cement used for linoleum and asphalt flooring.

matched boards
Boards cut with tongue and groove.

Matheson joint
A bell-and-spigot joint in wrought pipe.

maximum continuous load (P.P.)
The maximum load which can be maintained for a specified period.

Maxwell diagram (E.M.)
A combined diagram of loads and stresses used for the graphical solution of unknown stresses in a loaded truss.

measuring load (E.M.)
The specified standard load under which a chain is to be measured for length.

measuring means (A.C.)
Are those elements of an automatic controller which are involved in ascertaining and communicating to the controlling means the value of the controlled variable.

mechanical atomizing oil burner
A burner which uses the pressure of the oil for atomization.

mechanical draft
The negative pressure created by mechanical means.

mechanical efficiency
The ratio of power output to power input.

mechanical hysteresis (E.M.)
During a stress cycle, the ascending and the descending curves of a stress-strain diagram will not coincide. The failure to do so is the result of the dissipation of energy as heat and is called hysteresis.

mechanical stoker (P.P.)
A device consisting of a mechanically operated fuel feeding mechanism and a grate, and is used for the purpose of feeding solid fuel into a furnace, distributing it over the grate, admitting air to the fuel for the purpose of combustion, and providing a means for removal or discharge of refuse.

Overfeed Stoker. A stoker in which fuel is fed onto grates above the point of air admission to the fuel bed. Overfeed stokers are divided into four classes, as follows:

(a) A front feed inclined grate stoker is an overfeed stoker in which fuel is fed from the front onto a grate inclined downwards toward the rear of the stoker.

(b) A double inclined side feed stoker is an overfeed stoker in which the fuel is fed from both sides onto grates inclined downwards toward the center line of the stoker.

(c) A chain or traveling grate is an overfeed stoker having a moving endless grate which conveys fuel into and through the furnace where it is burned, after which it discharges the refuse.

(d) A spreader stoker is an overfeed stoker that discharges fuel into the furnace from a location above the fuel bed and distributes the fuel onto the grate.

Underfeed Stoker. A stoker in which fuel is introduced through retorts at a level below the location of air admission

to the fuel bed. Underfeed stokers are divided into three general classes, as follows:

(a) A side ash discharge underfeed stoker is a stoker having one or more retorts which feed and distribute solid fuel onto side tuyeres or a grate through which is admitted air for combustion and over which the ash is discharged at the side parallel to the retorts.

(b) A rear ash discharge underfeed stoker having a grate composed of transversely spaced underfeed retorts, which feed and distribute solid fuel to intermediate rows of tuyeres through which is admitted air for combustion. The ash is discharged from the stoker across the rear end.

(c) A continuous ash discharge underfeed stoker is one in which the refuse is discharged continuously from the normally stationary stoker ash tray to the ash pit, without the use of mechanical means other than the normal action of the coal feeding and agitating mechanism.

medium knot (arch.)

A knot over ¾", but not over 1½", in diameter.

mega-

A prefix meaning million megavolts, or megohms.

megawatt

A unit of energy equal to 1000 kilowatts.

megohm

A million ohms.

member

Any part of a structure or merchanism is called a member.

members (arch.)

The different parts of a building or an entablature, the different moldings of a cornice, and the like.

meta-anthracite

Highest coal classification according to rank. Dry fixed carbon 98% or more and dry volatile matter 2% or less, on a mineral matter free basis.

metal arc cutting

Metal arc cutting is the process of severing metals by melting with the heat of the metal arc.

metal-arc electrode

A metal-arc electrode is a wire or rod, either lightly coated or covered, through which current is conducted between the electrode holder and the arc to provide filler metal.

metal arc welding

Metal arc welding is an arc-welding process wherein the electrode supplies the filler metal in the weld.

meter,—a unit of length—standard meter

The distance between two engraved lines on a bar of platinum-iridium and used as a standard of measurement.

micro-

A prefix meaning one-millionth.

micron

One thousandth of a millimeter. One millionth of a meter, or 0.000 039 in. or 1/25400 in. The diameter of dust particles is often expressed in microns.

micron effciency curve (P.P.)

A curve showing the actual collection efficiency for each specific micron size.

microscope dust analysis (P.P.)

An analysis of dust particle size determined by microscopic measurement.

middle strip (arch.)

A portion of a flat slab panel one-half panel in width,

symmetrical about the panel center line and extending through the panel in the direction of the span considered for bending.

mil

One thousandth of an inch.

mild-steel electrodes

Ferrous electrodes designed primarily for welding mild steel with weld-tensile strengths, in general, not exceeding 75,000 pounds per square inch.

mill (F.&.C.)

See "pulverizer."

milli-

A prefix meaning one-thousandth; as milliamperes.

milliammeter

An ammeter reading thousandths of an ampere.

milling

Removing material from work by means of a revolving cutter as the work in a fixed position is fed against it. Many fixtures are designed so that work will be accurately and securely held during the milling operation.

millivoltmeter

A voltmeter reading thousandths of a volt.

mineral matter free basis (F.&.C.)

The method of reporting coal analysis whereby the ash plus other minerals which are in the original coal are eliminated and the other constituents recalculated to total 100%.

miniature boiler

Fired pressure vessels which do not exceed the following limits: 16″ inside diameter of shell; 42″ over-all length to outside of heads at center; 20 sq. ft. water heating surface; or 100 psi maximum allowable working pressure.

miscellaneous electrodes

All electrodes of a type or for purposes not specifically defined.

miter

A molding returned upon itself at right angles is said to miter. In joinery, when the ends of any two pieces of wood of corresponding form are cut off at 45°, they necessarily abut to form a right angle and are said to miter.

miter box

An apparatus for guiding a handsaw at the proper angle in making a miter joint in wood.

M.K.S. system

Is that system of units which bases everything upon the fundamental metric units of meter, kilogram and second.

module (E.M.)

Ratio of the pitch diameter to the number of teeth. Ordinarily, module is understood to mean ratio of pitch diameter IN MILLIMETERS to the number of teeth. The English module is a ratio of the pitch diameter in inches to the number of teeth.

Arch—The size of some one part taken as the standard unit of measurement in architectural plans.

modulus of elasticity (E.M.)

The ratio of unit stress to unit strain (or deformation) where the unit stress does not exceed the proportional limit of the material in tension or compression. *Syn. Coefficient of elasticity; Young's modulus.*

modulus of elasticity in shear; modulus of rigidity (E.M.)

The ratio of unit shear stress to unit shear strain, where the unit shear stress does not exceed the proportional limit of the material in shear.

modulus of resilience (E.M.)

A measure of strain energy per unit volume of material. It is calculated by the equation:

$$\frac{S^2}{2E}$$

S = proportional limit of the material
E = modulus of elasticity

modulus of rupture (E.M.)

A measure of the ultimate strength of a member found by loading the member to its rupture point and using the rupture load to compute its ultimate stress. In bending, the flexure formula.

$$S = \frac{MC}{I}$$

so used is called the *modulus of rupture in bending*, where M is the bending moment that causes rupture.
C = distance to the extreme fiber
I = moment of inertia

It should be noted that the modulus of rupture is a fictitious stress and does not represent the actual stress in the extreme fiber.

modulus of rupture in torsion (E.M.)

A measure of the ultimate strength of a member found by loading the member to its rupture point and using the rupture load to compute its ultimate stress. In torsion, the formula

$$S = \frac{TC}{J}$$

so used is called the *modulus of rupture in torsion*, where T is the twisting moment that causes rupture.
C = distance to the extreme fiber
J = polar moment of inertia

It should be noted that the modulus of rupture is a fictitious stress and does not represent the actual stress in the extreme fiber.

Mohr's circle (E.M.)
A graphical method for finding the moments of inertia with respect to an inclined set of axes. The method is also suitable for finding the principle stresses in a combined stress system of bending and torsion.

moisture
Water in the liquid or vapor phase.

moisture and ash free basis (F.&.C.)
Method of reporting coal analysis. See "dry ash free basis."

moisture in steam
Particles of water carried in steam usually expressed as the percentage by weight.

moisture loss (P.P.)
The loss representing the difference in the heat content of the moisture in the exit gases and that at the temperature of the ambient air.

molding (arch.)
Wood that has been milled into special shapes and designs for use as trim. When any work is wrought into long regular channels or projections, forming curves, rounds, hollows, or the like, it is said to be molded, and each separate member is a molding.

molding (foundry work)
"The act of making a casting by means of a pattern from which a mold is made." This is carried on in a foundry. Poor casting design will cause foundry problems.

moment of area (first moment of area) (E.M.)

The product of an area and its distance from an axis, usually given by the equation:

$$\int y \partial A$$

moment—moment of a force (E.M.)

The moment of a force or *torque* is a statical term which is mathematically defined as the magnitude of a force multiplied by the perpendicular from some axis.

moment of inertia (E.M.)

Moment of inertia is a property which cannot be defined physically. It is a mathematical measurement which designates a property. In statics, this property is a measure of the rigidity of a structural member. In dynamics it is a measure of the tendency of a mass to change its state of motion.

moment of inertia of an area (second moment of area) (E.M.)

A property of a plane surface found by multiplying each element of area dA by the square of its distance from an axis y. Thus

$$I = \int y^2 \partial A$$

If the axis is in the plane of the area, I is called the *rectangular moment of inertia.* If the axis is perpendicular to the plane of the area, I is the *polar moment of inertia.*

momentum (E.M.)

Is a measure of the motion of a body calculated by the product of mass and velocity. Thus,

$$\text{Momentum} = MV$$

Principle of the conservation of momentum, is stated: "The total momentum of two or more colliding bodies is unchanged by the collision." This is just another manner of stating Newton's third law of motion.

monolithic baffle (P.P.)
A baffle of poured or rammed refractory material.

mortar
A mixture of cement and sand used for bonding bricks and stone.

mortar joint
That point where two bricks or masonry blocks are joined together with mortar.

motion (E.M.)
Motion is defined as the continuous change of position.
Linear motion—motion in a straight line.
Curvalinear motion—motion along a curved path.

motor-generator
A generator driven by an electric motor.

motor operator (A.C.)
Is a portion of the controlling means which applies power for operating the final control element.

mousing (arch.)
Several turns of yarn or marline tied across the mouth of a hook and used to prevent a rope or another hook from becoming dislodged.

mud or lower drum (P.P.)
A pressure chamber of a drum or header type located at the lower extremity of a water tube boiler convection bank which is normally provided with a blow-off value for periodic blowing off of sediment collecting in the bottom of the drum.

mullion or munion (arch.)
(1) The perpendicular pieces of stone, sometimes like columns, sometimes like slender piers, which divide the bays or light of windows or screen-work from each other;
(2) A wooden or iron division between two windows.

multifuel burner (F.&.C.)

A burner by means of which more than one fuel can be burned, either separately or simultaneously, such as pulverized fuel, oil or gas.

multi-pass arrangement (P.P.)

Heat absorbing surfaces so baffled as to provide two or more passes in series.

multi-position action (A.C.)

Is that in which a final control element is moved to one of three or more predetermined positions, each corresponding to a definite range of values of the controlled variable.

multi-speed floating action (A.C.)

Is that in which a final control element is moved at two or more speeds each corresponding to a definite range of deviation. See floating action.

multiple action (A.C.)

is that in which two or more controller actions are combined.

multiple cyclone (P.P.)

A number of cyclone collectors connected in parallel.

multiple retort stoker (P.P.)

An underfeed stoker consisting of two or more retorts, parallel and adjacent to each other, but separated by a line of tuyeres. and arranged so that the refuse is discharged at the ends of the retorts.

multiple-shielded high-velocity thermocouple (P.P.)

A multiple-shielded furnace gas temperature measuring instrument arranged so that furnace gases are drawn over the junction of the thermocouple at high velocities.

multiple strand chain (E.M.)

A roller chain made up of two or more strands assembled

as a single structure on pins extending through the entire assembly.

multiport burner (P.P.)
A burner having a number of nozzles from which fuel and air are discharged.

multistage furnace (P.P.)
A combination of two or more connected furnaces in series.

muriatic acid
Hydrochloric acid used for cleaning cement.

mutual induction (elect.)
The inducing of an EMF in a circuit by the field of a nearby circuit.

N

natural aging (heat treat)
Spontaneous aging of a supersaturated solid solution at room temperature. See aging and compare with artificial aging.

natural beds (arch.)
In stratified rocks, the surface of a stone as it lies in the quarry. If not laid in walls in their natural bed, the layers separate.

natural circular frequency
See circular frequency.

natural circulation (P.P.)
The circulation of water in a boiler caused by differences in density.

natural draft stoker (P.P.)
A stoker in which the flow of air through the grate is caused by the difference of pressure between the furnace and the atmosphere.

natural finish (arch.)
Wood that is left with the natural coloring.

natural gas
Gaseous fuel occurring in nature.

needle valve
A valve in which the opening, consisting of a small hole, is opened or closed by means of a long needlelike spindle that is thrust into or withdrawn from the hole.

negative charge (elect.)

The electrical charge carried by a body which has an excess of electrons. (For example, a vulcanic rod, after it has been rubbed by fur or wool, carries a negative charge.)

net fan requirements

The calculated operating conditions for a fan, excluding tolerances.

neutral atmosphere

An atmospere which tends neither to oxidize nor reduce immersed materials.

neutral axis (E.M.)

The axis of zero fiber stress in a member subjected to a bending moment.

neutral surface (E.M.)

The longitudinal surface of zero fiber stress in a member subjected to a bending moment.

neutral zone (A.C.)

Neutral zone is a predetermined range of values of the controlled variable in which no change of position of the final control element occurs. Neutral zone is commonly expressed in percent of controller scale of range. A neutral zone is employed in some types of controller action.

In floating controller action, it is that position in which no motion of the final control element occurs.

neutron

A particle having the weight of a proton but carrying no electric charge.

newel post (arch.)

The post, plain or ornamented, placed at the first or lowest step so that the beginning of the hand-rail can be placed upon it.

newton

That force which imparts an acceleration of one meter per second squared to a mass of one kilogram.

Newton, Sir Isaac (1643-1727)

The scientist who first formulated the three natural laws of mechanics (viz.)

Newton's Laws of Motion

(1) First law; A body at rest or moving in a straight line will remain in that state unless acted upon by an external force.

(2) Second law; The acceleration of a body is directly proportional to the external force acting upon that body and inversely proportional to the mass of the body. The acceleration will be directed in the same path as the force vector.

(3) Third law; A force acting on a body in either static or dynamic equilibrium will be acted upon by a reactive force equal in magnitude to the first force but oppositely directed. This law is usually stated, "To every action there is an equal and opposite reaction."

niche

A recess sunk in a wall, generally for the reception of a statue.

nipple

A short piece of pipe used for connecting pipes or fittings.

nitriding

Introducing nitrogen into a solid ferrous alloy by holding at a suitable temperature in contact with a nitrogenous material, usually ammonia or molten cyanide of appropriate composition. Quenching is not required to produce a hard case.

nomography

See alignment chart.

non-bearing partition

A partition extending from floor to ceiling but which supports no load other than its own weight.

non-ferrous electrodes

Electrodes producing a weld deposit of essentially non-ferrous elements excepting chromium and nickel.

normal circular pitch (E.M.)

The shortest distance on the pitch surface between the centers or any other corresponding points of adjacent teeth—applied to helical gearing.

normal diametral pitch (E.M.)

The diametral pitch corresponding to the normal circular pitch and equal to number of teeth divided by the product of the pitch diameter and the cosine of the helix angle; also equals diametral pitch divided by cosine of the helix angle.

normal pressure angle (E.M.)

Applied to helical gears to indicate pressure angle in a plane normal or perpendicular to the teeth as distinguished from a plane that is perpendicular to the axis of the gear.

normalizing (heat treat)

Heating a ferrous alloy to a suitable temperature above the transformation range and then cooling in still air to room temperature.

Normandy joint (arch.)

In this type of joint the plain ends of two pipes are connected by a sleeve whose ends are made tight by rings of packing, compressed between bolting rings and the sleeve. Modifications include Dayton, Dresser, and Hammond joints.

nosings (arch.)

The rounded and projecting edges of the treads of a stair.

notch—sensitivity ratio (E.M.)

Syn. for "factor of stress concentration in fatigue or fatigue strength reduction factor."

novelty siding (arch.)
Wood siding cut into special designs.

nozzle
The outlet from a faucet or the end of a pipe line or hose, so designed that the issuing stream of water is thrown in a shape or size different from the diameter of the pipe.

Any projecting spout through which a fluid flows.

nucleus
The heavy or central part of an atom.

nut (F.&C.)
Anthracite coal designation through 1⅝", or 15/16" round mesh screen. Bituminous coal size designation by some chosen screen mesh size, as 2" x ¾".

nut and slack (F.&C.)
A combination of Nut and Slack coal, such as 2" x ¾" Nut plus ¾" x 0 Slack (see slack).

O

oakum
Hemp or old hemp rope soaked in oil to make it waterproof and used for caulking.

oblique
Not acting along perpendicular or horizontal axes but at some displaced angle.

offset (A.C.)
The steady state difference between the control point and the value of the controlled variable corresponding with the set point. Offset is an inherent characteristic of the positioning controller action.

offsets
When the face of a wall is not one continuous surface but rather sets in by horizontal jogs, the jogs are called offsets.

ohmmeter (elect.)
An electrical instrument for directly measuring ohms.

oil burner
A burner for firing oil.

oil cone (F.&C.)
The cone of finely atomized oil discharged from an oil atomizer.

oil gas
Gas produced from petroleum.

oil heating and pumping set
A group of apparatus consisting of a heater for raising the temperature of the oil to produce the desired viscosity, and a pump for delivering the oil at the desired pressure.

on center
From center to center.

open furnace
A furnace, particularly as applied to chain or traveling gratestoker firing, containing essentially no arches.

open return bend (P.P.)
Similar to a "close return bend" except that the arms are separated.

orange shellac
Shellac with natural coloring.

organic matter
Compounds containing carbon often derived from living organisms.

oriel window
A projecting, angular window, commonly triagonal or pentagonal in form. These windows are divided by mullions and transoms into different bays and compartments.

orifice (F.&C.)
The opening from the whirling chamber of a mechanical atomizer or the mixing chamber of a steam atomizer through which the liquid fuel is discharged.

orifice (P.P.)
A calibrated opening in a plate, inserted in a gas stream for measuring velocity of flow.

orsat
A gas-analysis apparatus in which certain gaseous constituents are measured by absorption in separate chemicl solutions.

oscillation (E.M.)
Any reciprocating motion is said to oscillate as a pendulum.

out of plumb
Not plumb; in other words, not level or vertical.

overaging (heat treat)
Aging under conditions of time and temperature greater than those required to obtain maximum change in a certain property, so that the property is altered in the direction of the initial value. See aging.

overall efficiency
The efficiency of two or more series connected machines acting as a unit is called the *overall efficiency* and is equal to the product of the individual efficiencies.

overchaining (E.M.)
A drive is overchained when it incorporates a chain of substantially higher rating than that indicated by normal selection procedures.

overdeck superheater
A superheater located above the tube bank of a straight tube boiler.

overfire air
Air for combustion admitted into the furnace at a point above the fuel bed.

overfire air fan
A fan used to provide air to a combustion chamber above the fuel bed.

over-gage diameter (E.M.)
The measurement over gage pins of specified diameter inserted in opposite tooth gaps of a sprocket. For an odd number of teeth, the pins are placed in the nearest opposite gaps.

overhaul (arch.)
To separate blocks of tackle.

overheating (heat treat)
Heating a metal or alloy to such a high temperature that its properties are impaired. When the original properties cannot be restored by further heat-treating, by mechanical working, or by a combination of working and heat-treating, the overheating is known as burning.

owner (arch.)
Any person having title to, or control as guardian or trustee of, a building or property.

oxidation
Chemical combination with oxygen.

oxidizing atmosphere
An atmosphere which tends to promote the oxidation of immersed materials.

oxygen attack
Corrosion or pitting in a boiler caused by oxygen.

ozone
An activated but unstable compound of oxygen arising from the molecular bombardment of air or gas in the region immediately surrounding a high voltage electrode.

P

packaged steam generator

A boiler equipped and shipped complete with fuel burning equipment, mechanical draft equipment, automatic controls and accessories.

packing

A soft material placed about a joint into which it is squeezed to prevent the passage of liquid or gas.

pad (P.P.)

See boss. A pad is larger than a boss and is attached to a pressure vessel to reinforce an opening.

pale (arch.)

A fence picket that is sharpened at the upper end.

palo-travis apparatus (P.P.)

Sedimentary method of particular size determination by measuring amount of particles settling out at given time intervals.

pane (arch.)

A term applied to each of the pieces of glass in a window; they are also called lights. See "lights."

panel

(1) A piece of wood framed within four other pieces of wood, as in the styles and rails of a door, to fill an opening;

(2) The whole square frame and the sinking itself;

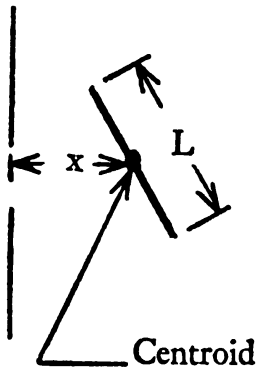
(3) The ranges of sunken compartments in wainscoting, cornices, corbel tables, groined vaults, ceilings, etc.

panel length (arch.)
The distance along a panel side from center to center of columns of a flat slab.

pantry
A compartment or closet in which provisions are kept.

papier-mache
A hard substance made of pulp from rags or paper mixed with size or glue and molded into any desired shape. This material is widely used for architectural ornamentations.

Papus' theorem (see Guildinus' theorem) (E.M.)
A theorem by which the surface area generated by a revolving line can be found. The theorem states that the surface area is the product of the length of the line and the length of the path generated by the centroid of the line.



Thus $A = 2\pi xL$

parallel
Running side by side in the same direction.

parallel axis theorem (E.M.)
A relation used for finding the moment of inertia of a body from any axis. It is stated thusly; the moment of inertia of a body about any axis is equal to the moment of inertia of the body about its center plus the product of the mass of the

body and the square of the distance between the axes. The equation is usually written:

$$I = I_{cg} + MD^2$$

parallel cascade action (A.C.)

Is the regulation of the set-points of two or more automatic controllers by the action of another automatic controller.

parging (arch.)

A thin coat of plastering applied to smooth off rough brick or stone walls.

partial pressure

The absolute pressure of a constituent of a gaseous mixture.

particle size (P.P.)

A measure of dust size, expressed in microns or per cent passing through a standard mesh screen.

parting strip (arch.)

A thin strip of wood nailed between the upper and lower sashes in a double hung window.

partition

A wall that subdivides space within any story of a building. See bearing partition and nonbearing partition.

partition tile

Tile for use in building interior partitions, subdividing areas into rooms, or similar construction, and carrying no superimposed loads.

patenting (heat treat)

In wire making, a heat-treatment applied to medium-carbon or high-carbon steel before the drawing of wire or between drafts. This process consists in heating to a temperature above the transformation range and then cooling to a

temperature below the temperature of phase changes at equilibrium in air or in a bath of molten lead or salt.

pattern making

"The making of a model, called a pattern, from wood or metal for foundry projects. . . ." This is a department that the tool designer must be in touch with, since it is often advantageous to make tool parts out of cast iron. If the casting design is a complicated one, factors involving (a) cost of making pattern and casting, (b) weight and size of casting, and (c) ease of casting and machining, should be considered and discussed with those competent to give advice on these questions.

pea (F.&C.)

Anthracite or Bituminous coal size. In Anthracite through 13/16″ over 9/16″ round hole screen, in bituminous ¾″ x ⅜″.

peak load

The maximum load carried for a stated short period of time.

peat (F.&C.)

An accumulation of compacted and partially devolatilized vegetable matter with high moisture content, an early stage of coal formation.

pedestal (arch.)

An upright compression member whose height does not exceed three times its least lateral dimension.

pedestal urinal

A urinal supported on a single pedestal and not connected to a wall for support.

peep door (P.P.)

A small door usually provided with a shielded glass opening through which combustion may be observed.

peep hole (P.P.)
A small hole in a door covered by a movable cover.

pendant tube superheater
An arrangement of heat absorbing elements which are substantially vertical and suspended from above.

pendulum (E.M.)
Ballistic: (see ballistic)
Compound: (see compound)
Kater's: A pendulum devised by Kater used for the measurement of absolute gravity.
Simple: A simple pendulum can be defined as a swinging particle at the end of a weightless cord.

penny (abbreviated—d) (arch.)
A measure of nail length. Originally, it indicated the price per hundred.

pent roof
A roof that is sloped on only one side.

perch
A unit of measure for stone work. In some localities a perch is equal to 24¾ cu. ft.; in others, 16⅔ cu. ft.

percussion, center of (E.M.)
For any rotating body with acceleration, the center of percussion is that point at which the resultant of applied forces intersects the normal axis. A common is a swinging baseball bat. When the player hits the ball at the center of percussion, he does not feel any "sting" because the bat is in dynamic equilibrium.

perfect combustion
The complete oxidation of all the combustible constituents of a fuel, utilizing all the oxygen supplied.

perforated plates
Steel plates having holes so distributed as to provide a

flow restriction and as a result, improve uniformity of gas velocity distribution when placed across gas entrance and/or exit to precipitators.

period of vibration (E.M.)
The period of vibration is the time interval in which a periodic motion repeats itself.

permalloy
An alloy containing 78.5 percent nickel and 21.5 percent iron. It has an abnormally high magnetic permeability.

permanent deformation (E.M.)
A deformation which will not return to normal upon the removal of stress.

permeability
A property of matter that indicates the ease with which it is magnetized.

perpendicular
A line running at right angles to another line, such as a wall to a floor. A vertical line.

perspective drawing (arch.)
The art of drawing an object on a plane surface so that it appears to the eye the same as the object itself would; that is, so that the drawing appears to have a third dimension.

pet cock (P.P.)
A ground-key faucet with an opening about ⅛ in. in diameter. Sometimes called an "air cock."

petrographic analysis
The determination of the structural, mineralogical and chemical character of slags.

petroleum
Naturally occurring mineral oil consisting predominately of hydrocarbons.

petroleum coke (F.&C.)
Solid carbonaceous residue remaining in oil refining stills after distillation process.

pH
The hydrogen ion concentration of a water to denote Acidity or Alkalinity. A pH of 7 is neutral. A pH above 7 denotes alkalinity while one below 7 denotes acidity. This pH number is the negative exponent of 10 representing hydrogen ion concentration in grams per liter. For instance a pH of 7 represents 10^{-7} grams per liter.

phase angle
The angular position of any sinusoidal plot is called the phase angle.

picket
A narrow board, often pointed, used in making fences.

picture molding
Special molding attached to the walls and from which pictures are hung. It can be made of either wood or plaster.

pier glass (arch.)
A large high mirror.

piers (arch.)
(1) The solid parts of a wall between windows and other openings.
(2) Masses of brickwork or masonry that are insulated to form supports to gates or to carry arches, posts, girders, etc.

pile (arch.)
A large stake or trunk of a tree driven into soft ground, as at the bottom of a river, or in made land, for the support of a building.

pillars (arch.)
The round of polygonal piers, or those surrounded with clustered columns, which carry the main arches of a building.

pilot light (P.P.)
A small flame, used in gas heating devices, that burns constantly to ignite the main gas supply when it is turned on.

pin
A cylindrical piece of wood, iron, or steel, used to hold two or more pieces together by passing through a hole in each of them, as in a mortise and tenon joint or a pin joint of a truss.

pin knot (arch.)
A knot not over ½″ in diameter.

pipe stock
A die holder.

pipe tongs
A hand tool for gripping or turning pipes.

pipe wrench
A wrench with slightly curved, serrated jaws designed to tighten the grip as the handle is turned. The jaws are replaceable.

pit sand
Sand taken directly from the pit.

pitch (arch.)
(arch.) The slope of a surface, such as a roof or the ground.

(E.M.) The distance between center lines of tubes, rivets, staybolts, braces, gears or any identical parts arranged in systematic order.

pitch circle (E.M.)
A circle the radius of which is equal to the distance from the gear axis to the pitch point.

pitch diameter (E.M.)
Diameter of the pitch circle (generally understood to

mean the diameter obtained by dividing the number of teeth by the diametral pitch or the diameter of the pitch circle when the center-to-center distance between mating gears is standard).

pitch pocket (arch.)
An opening between the grain of the wood containing more or less pitch. Pitch pockets are classified as small, medium and large.

pitch point (E.M.)
The point of tangency of the pitch circles or the point where the center-line of mating gears intersects the pitch circles.

pitching piece (arch.)
A horizontal timber, with one of its ends wedged into the wall at the top of a flight of stairs, to support the upper end of the rough strings.

pith (arch.)
In the case of wood, the small soft core occurring in the structural center.

pith knot (arch.)
A sound knot with a pitch hole not more than ¼" in diameter in the center.

pitot tube
An instrument which will register total pressure and static pressure in a gas stream, used to determine its velocity.

pitting
A concentrated attack by oxygen or other corrosive chemicals in a boiler, producing a localized depression in the metal surface.

plain concrete
Concrete without reinforcement, or reinforced only for shrinkage or temperature changes.

plane

(1) Of a surface, flat.

(2) In joinery, a tool used to smooth the surface of wood to make mouldings and the like.

planing

Removing metal in order to produce flat smooth, surfaces, by moving the table to which the work is fastened back and forth under the tool. Used for work which is too large to be machined on a milling machine or shaper.

plank

A heavy board.

plaster

A mixture of sand, water, lime or some other binder, and perhaps a fiber for added strength. The mixture hardens on drying. It is used to coat walls and ceilings.

plaster grounds

Wood strips which are attached along the bases of walls and around windows, doors, and other openings where wood trim is to fit over the edge of plaster. They provide a nailing base for the trim.

plastering

Covering walls or ceilings with plaster or a similar material. The plaster is applied to laths which have been nailed to the walls.

plastic flow (flow) (E.M.)

See "creep."

plastic slag

Slag in a viscous state.

plasticity (E.M.)

The property of being able to yield without rupture.

plate (arch.)

The piece of timber that supports the end of the rafters

in a building. Usually, the 2" x 4" timbers running horizontally on the top of wall studding.

plate (P.P.)
A flat surface through which heat is transferred in a plate air heater.

plate air heater
See air heater.

plate baffle
A metal baffle.

plate current (elect.)
The current that flows from the plate of a vacuum tube.

plate glass
Heavy glass used for large areas, such as store display windows.

platen (P.P.)
A plane surface receiving heat from both sides and constructed with a width of one tube and depth of two or more tubes, bare or with extended surfaces.

platform framing (arch.)
A system of framing a building in which floor joists of each story rest on the top plates of the story below (or on the foundation sill for the first story) and the bearing walls and partitions rest on the sub-floor of each story.

plenum
An enclosure through which gas or air passes at relatively low velocities.

plinth
The square block at the base of a column or pedestal. In a wall, the term plinth is applied to the projecting base or water table.

plug (P.P.)
A pipe fitting with outside thread and projecting head (usually square) used for closing the opening in another fitting. Also, sometimes, a faucet.

plug cock
Same as a "ground-key faucet."

plugging (P.P.)
An expression used to describe the building up of dust particle formations to the extent gas passages are sealed.

plumb
Perpendicular or in a perfectly upright position; standing according to a plumb line. For example, the post of a house or wall is said to be plumb.

plumb cut
The top cut, where the rafter joins the ridge board.

plumb line
A line or cord weighted at one end used to determine verticality.

plumber
A person trained and experienced in the art of plumbing.

plumber's friend
A cup-shaped device of rubber on the end of a wooden or metal handle; used for forcing out stoppages in pipes. Called also a "pneumatic plunger."

plumber's furnace
A gasoline or kerosene firepot used for melting solder or heating soldering irons, and similar service.

plumber's rasp
A course rasp for filing lead.

plumber's round iron
A special form of soldering iron used for soldering seams in tanks.

plumber's soil
A mixture of lampblack and glue used in lead work.

plumbing
The system of pipes and other apparatus employed in conveying water and sewage in a building.

plumbing system
The plumbing system of a building includes the water distributing pipes; the fixtures and fixture traps; the soil, waste, and vent pipes; the house drain, the foundation drain, and the house sewer; the storm-water drainage; drainage ejectors; all with their devices, appurtenances, and connections within or on a building or premises.

plunger (F.&C.)
An element of a stoker having a reciprocating motion by means of which solid fuel, such as coal, is propelled into a fuel bed or onto a fuel distributor. Fuel rate may be controlled by varying the frequency or amplitude of the reciprocating motion.

ply (arch.)
Term used to denote the number of thicknesses of roofing paper, as three-ply, four-ply, etc.

plywood
A piece of wood made of three or more layers of veneer joined with glue and usually laid with the grain of adjoining plies at right angles. Almost always an odd number of plies are used to secure balanced construction.

pneumatic conveying
The transportation of fuel through a conduit by air.

pointing (arch.)

Filling joints in masonry with mortar and then striking or troweling the joint with the point of the trowel to give a finished appearance. Also, the material used for pointing.

Poisson's ratio—"factor of lateral contraction" (E.M.)

The ratio of the lateral unit deformation to the linear unit deformation of a stressed bar within the elastic limit.

polar moment of inertia (E.M.)

The moment of inertia, I, of a figure relative to an axis which is perpendicular to the plane of the area is called the polar moment of inertia. It is mathematically defined as the sum of the moments of intertia along the X and Y planes. Thus:

$$I_z = I_{xx} + I_{yy}$$

See "moment of inertia of an area."

polarity (elect.)

The character of having magnetic poles, or electric charges.

pole (elect.)

One of the ends of a magnet where most of its magnetism is concentrated.

pop valve

A safety valve that is kept closed by the pressure of a spring against the valve, which is released when the inside pressure overbalances that of the spring.

popping pressure (P.P.)

The pressure at which a safety valve opens.

porch

A floor extending beyond the exterior walls of a building. It may be enclosed or unenclosed, roofed, or uncovered.

porcupine boiler
A boiler consisting of a vertical shell from which project a number of dead end tubes.

porous structural clay tile
Tile in which the natural porosity of the clay has been increased by the admixture of other ingredients.

port (P.P.)
An opening through which fluid passes.

portland cement
A hydraulic cement made by burning and grinding a mixture of pure limestone and clay, or of other aluminous material.

positioning action (A.C.)
Is that in which there is a predetermined relation between the value of the controlled variable and the position of a final control element.

positive charge (elect.)
The electrical charge carried by a body which has become deficient in electrons. (For example, a glass rod, after it has been rubbed by silk, carries a positive charge.)

post
A piece of timber, metal or similar material that is fixed firmly upright, especially when it is meant to serve as a support.

postheating (heat treat)
Heating weldments immediately after welding, for tempering, for stress relieving, or for providing a controlled rate of cooling to prevent formation of a hard or brittle structure.

potential (elect.)
The amount of charge held by a body.

pothook (P.P.)
A hook used for lifting the lead pot from the furnace.

pound

The unit of force equal to the gravitational attraction on a standard cylinder of platinum-iridium at 45 degrees north latitude is called the pound.

power

Power is the time rate of doing work. In the English system, the unit of power is one foot-pound per second. In the majority of engineering applications, this unit is too small to be practical. A much larger unit called the horsepower (hp) is in use today. One horsepower is equal to 33,000 foot-pounds per minute or 550 foot-pounds per second.

power control valve

A safety valve opened by a power driven mechanism.

power input

The energy required to drive a machine at the input shaft.

power output

The energy delivered by a machine at the output shaft.

ppm

Abbreviation of parts per million. Used in chemical determination as one part per million parts by weight.

precession

See gyroscope.

precipitate

To separate materials from a solution by the formation of insoluble matter by chemical reaction. The material which is removed.

precipitation

The removal of solid or liquid particles from a fluid.

precipitation hardening (heat treat)

Hardening caused by the precipitation of a constituent

from a supersaturated solid solution. See artificial aging, interrupted aging, and progressive aging.

precipitator (F.&C.)
An ash separator and collector of the electrostatic type.

precision in measurement (A.C.)
The degree of reproducibility among several independent measurements of the same true value under specified conditions. It is usually expressed in terms of deviation in measurement.

preheated air
Air at a temperature exceeding that of the ambient air.

preheating
Heating before some further thermal or mechanical treatment. For tool steel, heating to an intermediate temperature immediately before final austenitizing. For some non-ferrous alloys, heating to a high temperature for a long time in order to homogenize the structure before working.

pressure
Force per unit of area.

pressure angle
The pressure angle of a pair of mating involute gears is the angle between the line of action and a line perpendicular to the center-line of these gears. (See also normal pressure angle.)

pressure drop
The difference in pressure between two points in a system, at least one of which is above atmospheric pressure, and caused by resistance to flow.

pressure-expanded joint
A tube joint in a drum, header or tube sheet expanded

by a tool which forces the tube wall outward by driving a tapered pin into the center of a sectional die.

pressure system pulverizer (P.P.)
A pulverizer located on the discharge side of primary air blower.

pressure vessel
A closed vessel or container designed to confine a fluid at a pressure above atmospheric.

primary air (P.P.)
Air introduced with the fuel at the burners. In direct-fired systems this may be the same as pulverizer air, although in some cases the pulverizer air is augmented by air by-passed around the pulverizer or bled in at the exhauster suction.

primary air fan
A fan to supply primary air for combustion of fuel.

primary branch
A primary branch of the building drain is the single sloping drain from the base of a stack to its junction with the main building drain or with another branch thereof.

primary element (A.C.)
Is that portion of the measuring means which first either utilizes or transforms energy from the controlled medium to produce an effect which is a function of change in the value of the controlled variable. The effect produced by the primary element may be a change of pressure, force, position, electrical potential, or resistance.

primary feedback (A.C.)
Is a signal which is related to the controlled variable and which is compared with the reference input to obtain the actuating signal.

primary furnace
The first furnace of the series in a multistage furnace.

priming (P.P.)
The discharge of steam containing excessive quantities of water in suspension from a boiler, due to violent ebullition.

priming (arch.)
The laying on of the first coat of paint. This coat is usually high in oil content; its purpose is to protect and fill the wood.

principal axes (E.M.)
The two perpendicular axes passing through some specified point in the plane of an area.

principal moment of inertia (E.M.)
The moment of inertia of an area about one of the principal axes.

private sewer
A privately owned sewer.

privy
An outhouse or structure used for the deposition of human excrement.

privy vault
A pit beneath a privy in which excrement collects.

process (A.C.)
The collective functions performed in and by the equipment in which a variable is to be controlled. "Equipment," as embodied in this definition, should be understood not to include any automatic control equipment. The *process* may also be referred to as the *controlled system.*

process annealing (heat treat)
In the sheet and wire industries, heating a ferrous alloy to a temperature close to, but below, the lower limit of the transformation range and then cooling, in order to soften the alloy for further cold working.

process stream

Steam used for industrial purposes other than for producing power.

producer gas (F.&C.)

Gaseous fuel obtained by burning solid fuel in a chamber where a mixture of air and steam is passed through the incandescent fuel bed. This process results in a gas, almost oxygen free containing a large percentage of the original heating value of the solid fuel in the form of CO and H_2.

products of combustion (F.&C.)

The gases, vapors, and solids resulting from the combustion of fuel.

profile (arch.)

(1) The outline or contour of a part or of the parts composing an order.

(2) The perpendicular section.

progressive aging (heat treat)

Aging by increasing the temperature in steps or continuously during the aging cycle. See aging and compare with interrupted aging.

projected gate area (F.&C.)

The horizontal projected area of the stoker grate.

proof stress (E.M.)

The specified tensile stress which a metal must sustain while its deformation remains within a specified amount.

proportional band (A.C.)

When applied to proportional-position controller action, it is the range of values of the controlled variable which corresponds to the full operating range of the final control element. Proportional band is commonly expressed in units of the controlled variable or percent of the controller scale range.

proportional limit (E.M.)
The maximum stress that a material can sustain and remain within the straight line law of stress-strain proportionality.

proportional plus floating action (A.C.)
Is that in which proportional-position action and floating action are combined.

proportional plus proportional-speed floating action (A.C.)
Is that in which proportional-position action and proportional-speed floating action are combined.

proportional plus rate action (A.C.)
Is that in which proportional-position action and rate action are combined.

proportional plus reset action (A.C.)
Is that in which proportional-position action and reset action are combined.

proportional plus reset plus rate action (A.C.)
Is that in which proportional-position action, reset action, and rate action are combined.

proportional-position action (A.C.)
is that in which there is a continuous linear relation between the value of the controlled variable and the position of a final control element.

proportional-speed floating action (A.C.)
Is that in which the final control element is moved at a speed proportional to the deviation. See floating action.

protected waste pipe
A waste pipe from a fixture that is not directly connected to a drain, soil, vent, or waste pipe.

proton
A positively charged particle whose charge is equal, but opposite, to that of the electron.

protractor
A mathematical instrument designed for laying down and measuring angles on paper. It is used in drawing or plotting.

province (F.&C.)
The largest division in classifying a coal producing area. The six provinces in the United States being: Eastern Interior, Gulf, Northern Great Plains, Rocky Mountain, and Pacific Coast.

proximate analysis
See "analysis, proximate."

pseudocarburizing
See blank carburizing.

pseudonitriding
See blank nitriding.

public sewer
A publicly owned sewer. A sewer to which all abutters have equal rights of connection. A common sewer.

puddle (arch.)
Clay, or similar material, worked, when wet, in order to render it impervious to water.

puff (F.&C.)
A minor combustion explosion within the boiler furnace or setting.

pugger (F.&C.)
A fireclay plug forced into the slag discharge spout or tap hole of an intermittent discharge slag tap furnace. Also a pug mill, which is a device in which water is mixed with flue dust for ease of handling.

pugging (arch.)
A course kind of mortar laid on the boarding between

floor joists to prevent the passage of sound; also called deafening.

pulsation (F.&C.)
Rapid fluctuations in furnace pressure.

pulverized fuel
Solid fuel reduced to a fine size.

pulverized-fuel feeder
An apparatus for the controlled delivery of pulverized fuel from a storage bin.

pulverizer (F.&C.)
A machine which reduces a solid fuel to a fineness suitable for burning in suspension.

(1) High Speed (over 800 rpm)
  (a) IMPACT PULVERIZER—A machine wherein the major portion of the reduction in particle size of the fuel to be pulverized is effected by fracture of larger sizes by sudden shock, impingement, or collision of the fuel with rotating members and casing.
  (b) ATTRITION PULVERIZER — A machine wherein the major portion of the reduction in particle size is by abrasion, either by pulverizer parts on coal, or by coal on coal.

(2) Medium Speed (between 70 and 300 rpm)
  (a) ROLLER PULVERIZER—A machine having grinding elements consisting of conical or cylindrical rolls and a bowl, bull-gring, mating rings, or table, any of which may be the rotating member, the fuel to be pulverized being reduced in size by crushing and attrition between the rolls and the rings.
  (b) BALL PULVERIZER—A machine in which the grinding elements consist of one or more circular

rows of metal balls arranged in suitable raceways, wherein the fuel to be pulverized is reduced in size by crushing and attrition between the balls and raceways.

(3) Low Speed (under 70 rpm)

(a) BALL OR TUBE PULVERIZER—A machine having a rotatable cylindrical or conical casing charged with metal balls or slugs and the fuel to be pulverized, reduction in particle size being effected by crushing and attrition due to continuous relative movement of the charge on rotation of the casing.

pulverizer air

Air which is passed through a pulverizer to dry and convey the pulverized fuel to the burners in direct-fired systems, or to the cyclone in storage systems. (Gas is sometimes used for the same purpose in storage systems.)

pulverizer exhauster

A fan connected to the outlet of a pulverizer and used to draw pulverizer air through a pulverizer and in some cases to augment the pulverizer air by the addition of primary air.

pumice stone

A finely ground stone used for polishing.

punching

The making of regular and irregular shaped holes or openings in sheet metal with a die by means of a press exerting great pressure.

purge meter interlock

A flow meter so arranged that an air flow through the furnace above a minimum amount must exist for a definite time interval before the interlocking system will permit an automatic ignition torch to be placed in operation.

purity
The degree to which a substance is free of foreign materials.

purlins (arch.)
Those pieces of timber which support the rafters to prevent them from sinking.

pusher (F.&C.)
A device for giving motion to fuel in a fuel bed by reciprocating motion, such as a moving block in the bottom of a retort.

putlog
Horizontal pieces which support the floor of a scaffold. One end is inserted into a putlog hole that was left in the masonry for that purpose.

putty
(1) A plastic made of powdered whiting and linseed oil.
(2) Lump lime slacked with water to the consistency of cream and then left to harden by evaporation until it resembles soft putty. It is then mixed with plaster of Paris or sand for the finishing coat.

pyramid
A solid having a particular form. One side, called a base, is a plane figure, and the other sides are triangles. The points of the triangular sides join at one point at the top, called the vertex. A pyramid is called triangular, square, etc., according to the form of its base.

pyrites
A compound of iron and sulfur naturally occurring in coal.

Q

quality

A term used to designate the percentage of water in steam. (See wetness, steam quality)

quarry

(1) A rock bed.

(2) A pane of glass cut in the shape of a diamond or a lozenge.

quench aging (heat treat)

Aging induced by rapid cooling after solution heat-treatment.

quench annealing (heat treat)

Annealing an austenitic ferrous alloy by solution heat-treatment.

quench hardening (heat treat)

Hardening a ferrous alloy by austenitizing and then cooling rapidly enough so that some or all of the austenite transforms to martensite.

quenching (heat treat)

Rapid cooling. When applicable, the following more specific terms should be used: direct quenching, fog quenching, hot quenching, interrupted quenching, selective quenching, spray quenching, and time quenching.

R

rabbet

(1) A continuous small recess, generally understood as having a right angle included between its sides, especially one whose sides enclose a relatively restricted area.

(2) A groove cut in wood along the edge, particularly to receive the edge of another piece of wood and form a rabbet joint.

(3) A recess formed by two planes, very narrow as compared with their length, such as the small recess on a door frame, into which the edge of a door is made to fit; the recess of a brick jamb to receive a window frame; and the like.

rabbet plane

A plane used for cutting rabbets on the edges of timber.

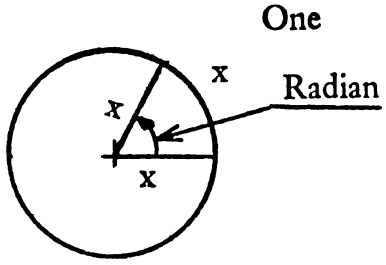
rack stick

A small wooden stick 1 inch to 1½ inches in diameter and from 24 to 36 inches in length.

radian (E.M.)

One radian is the central angle subtended in a circle by an arc whose length is equal to the radius of the circle. Hence if we wish to express an angular measure in terms of radians, we must find the ratio of the arc the angle subtends to the radius of the circle. An angle in radians, being defined as a ratio of like units, is a dimensionless quantity or a pure number as some term it. The importance of radian measure is

that this ratio is constant for all circles and therefore becomes a property of the circle.

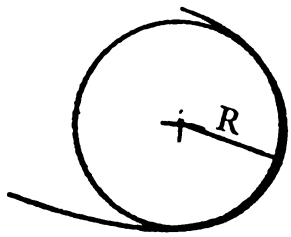


radiant-type superheater
See superheater.

radiation loss (P.P.)
A comprehensive term used in a boiler-unit heat balance to account for the conduction, radiation, and convection heat losses from the settings to the ambient air.

radius
A distance from the center of a circle to the outside edge; one-half of the diameter.

radius of curvature (E.M.)
The radius of curvature is that radius with which we can construct a circle whose curvature is the same as the curvature of any general curve. Mathematically it is defined as the reciprocal of the curvature at a point on the curve.



radius of gyration (E.M.)
The radius of gyration is that distance K from a reference axis at which a mass can be considered to be concentrated

without altering its moment of inertia. It is defined mathematically by the formula

$$K = \sqrt{\frac{I}{A}}$$

I = moment of inertia
A = area

rafters

The joists to which the roof-boarding is nailed. PRINCIPAL rafters are the upper timbers in a truss, having the same inclination as the common rafters. The rafters of a flat roof are sometimes called roof joists. See also hip rafter, jack rafter, and valley rafter.

rail (arch.)

A piece of metal or timber extending from one post to another, as in fences, balustrades, staircases, etc. In framing and paneling, the horizontal pieces are called rails; the perpendicular, stiles.

raised-face flange (P.P.)

A flange faced about 1/32 in. higher inside the bolt circle.

rake

The angle of the cutting edge of a tap or die.

rake joint

Type of mortar joint between bricks. The mortar is raked out of the joint to a certain depth before it sets.

raking (arch.)

Moldings whose arrises are inclined to the horizon.

ram (P.P.)

A form of plunger used in connection with underfeed stokers to introduce fuel into retorts. Also a form of pusher.

ramp

(1) A concavity on the supper side of hand railings

formed over risers, made by a sudden rise of the steps above;

(2) Any concave bend or slope in the cap or upper member of any piece of ascending or descending workmanship.

random work (arch.)

A term used by stone masons to describe stones fitted together at random without any attempt at laying them in courses. Random coursed work is a term applied to work coursed in horizontal beds when the stones are of any height.

range closet (arch.)

A battery of seats placed close together, or one continuous opening in a seat, all placed above a single water-bearing trough or receptacle designed to receive human fecal matter. See also "latrine."

range work (arch.)

Ashlar laid in horizontal courses. This term is synonymous with coursed ashlar.

rank (F.&C.)

Method of coal classification based on the degree of progressive alteration in the natural series from brown coal to meta-anthracite. The limits under classifications according to rank are on a mineral matter free basis.

rapping (P.P.)

A periodic vibrating of collecting and discharge electrodes to overcome the adhesion of dust for discharge into hoppers.

rasp

A coarse file used mainly for filing rough surfaces. Like files, rasps are classified from rough to smooth.

rate action (A.C.)

Is that in which there is a continuous linear relation between the rate of change of the controlled variable and the position of a final control element. This controller action

maintains a linear relation between the first derivative or the rate of change of the controlled variable and the position of a final control element. This identical controller action may also be considered as maintaining a linear relation between second derivative or rate of the rate of change of the controlled variable and the rate of motion of the final control element.

rate of blowdown

A rate normally expressed as a percentage of the water fed.

rate time (automatic controls applying to proportional plus rate controller action and proportional plus reset plus rate controller action)

The time interval by which the rate action advances the effect of the proportional-position action upon the final control element. Rate time is commonly expressed in minutes. It is determined by subtracting (1) the time required for a selected motion of the final control element, due to the combined effect of proportional-position plus rate actions, from (2) the time required for the same motion due to the effect of the proportional-position action alone, with the same rate of change of the controlled variable in both cases.

rated capacity (P.P.)

The manufacturer's stated capacity rating for mechanical equipment, for instance, the maximum continuous capacity in pounds of steam per hour for which a boiler is designed.

rating

See load.

ratio of gearing (E.M.)

Ratio of the numbers of teeth on mating gears. Ordinarily the ratio is found by dividing the number of teeth on the larger gear by the number of teeth on the smaller gear or pinion. For example, if the ratio is 2 or "2 to 1," this usually

means that the smaller gear or pinion makes two revolutions to one revolution of the larger mating gear.

raw-fuel feeder (P.P.)
A machine for the controlled delivery of raw fuel.

raw-fuel gate (P.P.)
A shut-off gate between the raw-fuel bin and the raw-fuel feeder.

raw water (P.P.)
Water supplied to the plant before any treatment.

reaction
A chemical transformation of change brought about by the inter-action of two substances.

ream
To cut the burr from the inside of a pipe.

reamer
A tool used in reaming.

reaming
Sizing and finishing a tapered or straight hole by means of a cutting tool (reamer) having several cutting edges. This method serves to make the hole smoother, straighter, and more accurate.

rear discharge stoker (P.P.)
A stoker so arranged that refuse is discharged from the grate surface at the end opposite the coal feed.

reassociation (F.&C.)
The recombination of the products of dissociation.

rebate (arch.)
A groove or channel cut in the edge of a board, a rabbet.

recess (arch.)
A depth of some inches in the thickness of a wall, as a niche, etc.

recessed tube wall (P.P.)
A refractory furnace wall with slots in which waterwall tubes are placed so that the tubes are partially exposed to the furnace.

reciprocating grate (P.P.)
A grate element which has reciprocating motion, usually for the purpose of fuel agitation.

recirculating line (P.P.)
Piping and connections on a heat exchanger through which fluid is returned from the outlet to the inlet.

recirculation (P.P.)
The reintroduction of part of the flowing fluid to repeat the cycle of circulation.

recirculator tube (P.P.)
A connection between upper and lower waterwall headers to return water to the lower header.

recrystallization annealing (heat treat)
Annealing cold-worked metal to produce a new grain structure without phase change.

rectangular moment of inertia (E.M.)
See moment of inertia of an area.

rectifier (elect.)
Mechanical—An arrangement of rotating contacts driven by a synchronous speed motor, for interrupting alternating current (A.C.) at half cycle intervals to provide uni-directional current. May be used in high voltage circuits for energizing electrostatic precipitators.

rectify (elect.)
To change an alternating current to a unidirectional or direct current.

rectilinear motion (E.M.)
Straight line motion.

recuperative heater
See air heater.

red lead
A paint primer used on metal.

reducer (P.P.)
A pipe fitting with inside threads, larger at one end than at the other. All such fittings having more than one size are reducers because of the custom of stating the largest size first. See also increaser.

reducing atmosphere
An atmosphere which tends to promote the removal of oxygen from a chemical compound.

reduction
Removal of oxygen from a chemical compound.

reduction of area (E.M.)
The difference between the cross sectional area of a specimen undergoing a tension test before a load is applied and after rupture. The reduction in area is usually expressed as a percentage of the original area.

redundant members (E.M.)
See counter diagonals.

reef
Another name for square knot.

reeve
To pass rope through blocks for making a tackle rigging.

reference input (A.C.)
The reference signal in an automatic controller. The reference input is the output signal of the reference input elements as determined by their response to the set point input signal. It has the same units as the primary feedback.

refinery gas

The commercially non-condensible gas resulting from fractional distillation of crude oil, or the cracking of crude oil or petroleum distillates. Refinery gas is either burned at the refineries or supplied for mixing with city gas.

refractory baffle

A baffle of refractory material.

refractory wall (P.P.)

A wall made of refractory material.

refuse (F.&C.)

The solid portions of the products of combustion.

regenerative heater

See Air Preheater.

register (P.P.)

The apparatus used in a burner to regulate the direction of flow of air for combustion.

reheated steam

Superheated steam which derived its superheat from a Reheater.

reheater

Heat transfer apparatus for heating steam after it has given up some of its original heat in doing work.

reheating

The process of adding heat to steam to raise its temperature after it has done part of its intended work. This is usually done between the high pressure and low pressure sections of a compound turbine or engine.

reinforced concrete

Concrete in which reinforcement other than that provided for shrinkage or temperature changes is embodied in

such a manner that the two materials act together in resisting forces.

reinforced concrete stack
A stack constructed of concrete reinforced by steel.

reinjection
The procedure of returning collected fly ash to the furnace of a boiler for the purpose of burning out its carbon content.

relative humidity
The ratio of the weight of water vapor present in a unit volume of gas to the maximum possible weight of water vapor in unit volume of the same gas at the same temperature and pressure.

relay
Replacing the strands of rope (as opposed to unlay).

relay (elect.)
An electrically operated device for the closing and opening of a circuit.

relay-operated controller (A.C.)
A controller in which the energy transmitted through the primary element is either supplemented or amplified for operating the final control element by employing energy from another source. This type of automatic controller may have either a self-operated measuring means and a relay-operated controlling means, or a relay-operated measuring means and a self-operated controlling means, or a relay-operating measuring means and a relay-operated controlling means.

releaser
See riser tube.

relief vent
A relief vent is a vent the primary function of which is

to provide circulation of air between drainage and vent system.

reluctance (elect.)

A measure of the resistance of a material to magnetic lines of force.

rendering

(1) In drawing, finishing a perspective drawing to bring out the spirit and effect of the design.

(2) The first coat of plaster on brick or stone work.

repairs (arch.)

The reconstruction or renewal of any existing part of a building or its fixtures or appurtenances.

reset action (A.C.)

Is that in which the final control element is moved at a speed proportional to the extent or proportional-position action. This term applies only to a multiple action including proportional-position action.

reset rate (automatic controls applying to proportional plus reset controller action and proportional plus reset plus rate controller action)

The number of times per minute that the effect of the proportional-position action upon the final control element is repeated by the proportional-speed floating action. Reset rate is commonly expressed as a number of "repeats" per minute. It is determined by dividing (1) the travel of the final control element in 1 minute due to the effect of proportional-position action, with the same deviation in both cases.

residual fuels

Products remaining from crude petroleum by removal of some of the water and an appreciable percentage of the more volatile hydrocarbons.

resistance (A.C.)
Opposition to flow. It is measured in units of potential change required to produce unit change in flow.

resistance (elect.)
The opposition of a conductor to an electric current.

resistance
Impediment to gas flow, such as pressure drop or draft loss through a dust collector. Usually measured in inches water gage ("w.g.")

resolution sensitivity (A.C.)
The minimum change in the measured variable which produces an effective response of the instrument or automatic controller. Resolution sensitivity may be expressed in units of the measured variable or as a fraction or percent of the full scale value, or the actual value.

resonance (E.M.)
When a disturbing force acts at the same frequency as the natural frequency of a body, the condition is known as resonance. Large amplitudes are the result of resonance and can be dangerous.

responsiveness (A.C.)
The smallest value of a measured quantity which will cause motion of an instrument indicator. If a scale, when reading ten pounds, requires a minimum change in weight of one ounce to move the pointer, the *responsiveness* of the instrument is one ounce.

restitution, coefficient of
The coefficient of restitution, e, is defined as the ratio of relative velocities of two colliding bodies after impact to the relative velocities before impact.

resultant (E.M.)
That calculated force whose effect is the same as a system

of forces and can be used to replace the force system is called the resultant. (Also see vector).

retaining wall
See Wall, Retaining.

retarder (P.P.)
A straight or helical strip inserted in a fire tube primarily to increase the turbulence.

retentivity (elect.)
The property of retaining magnetism.

retort (P.P.)
A trough or channel in an underfeed stoker, extending within the furnace, through which fuel is forced upward into the fuel bed.

retractable blower (P.P.)
A soot blower in which the blowing element can be mechanically extended into boiler setting and retracted.

return (arch.)
The continuation of a molding, projection, etc., in an opposite direction.

return bend (P.P.)
An open return bend, usually with inside threads, but applied also to a 180° bend in a pipe.

return flow oil burner
A mechanical atomizing oil burner in which part of the oil supplied to the atomizer is withdrawn and returned to storage or to the oil line supplying the atomizer.

return offset (P.P.)
A return offset or jumpover is a double offset designed to return the slope to its original line. See also "crossover fitting."

reversed effective force (E.M.)

An accelerating system can be placed in static equilibrium by applying the inertia force,

$$\frac{W}{G}a$$

in a reversed direction. The reversed inertia force is sometimes referred to as the reversed effective force.

See "D'Alembert's Principle."

rice (F.&C.)

Anthracite coal size, otherwise known as No. 2 Buckwheat—through 3/16" over 3/16" round mesh screen.

riffle (P.P.)

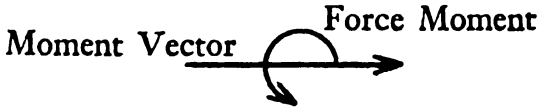
A device for diverting material into two or more equal parts, comprising a number of narrow sloping chutes of equal width, having a common inlet and having adjacent chutes diverging to separate outlets; a laboratory device. Also used on some exhauster outlets to divide mixtures of pulverized coal and air.

rifled tube (P.P.)

A tube which is helically grooved on the inner wall.

right hand rule

In the vector representation of moments, the vector is depicted along an axis in such a manner that if the extended thumb of the right hand points in the direction of the moment vector, the curled fingers of the hand are in the same direction as the force moments.



rigid body

Conventionally, a rigid body is one which shows negligible

strain under stress. Actually, all bodies will show some strain under stress, however, metals and harder materials often constitute a rigid body.

Ringelmann chart (F.&C.)
A series of four rectangular grids of black lines of varying widths printed on a white background, and used as a criterion of blackness for determining smoke density.

riser (arch.)
A water-supply pipe that extends vertically one full story or more to convey water to branches or fixtures.

riser tube
A tube through which steam and water passed from an upper waterwall header to a drum.

rolled joint
A joint made by expanding a tube into a hole by a roller expander.

roofing
The material put on a roof to make it watertight.

root circle (E.M.)
A circle coinciding with the bottoms of the tooth spaces.

root diameter (E.M.)
Diameter of the root circle.

rope scale (P.P.)
A rope-like deposit of solids at the water line in a sloping generating tube which is not full of water.

rotary oil burner
A burner in which atomization is accomplished by feeding oil to the inside of a rapidly rotating cup.

rotary valve
A device having a parted cylinder which rotates on cylin-

drical faces to form a pressure seal, used for discharging dust from a hopper.

rough lumber
Lumber that has not been surfaced or dressed.

roughcast
A sort of external plastering in which small, sharp stones are mixed. When it is wet it is forcibly thrown or cast from a trowel against the wall, to which it adheres to form a coating of attractive appearance. When done well, the work is sound and durable. The mortar for roughcast work should always have cement mixed with it.

roughing-in
The installation of all pipes in the plumbing that are in partitions and under floors. It includes the plumbing work done before the setting of the fixtures, or finishing.

round-in (run-in)
To bring blocks of tackle closer together.

round knot (arch.)
A knot in lumber whose sawn section is oval or circular.

R.P.M.
Revolutions per minute.

rubble work
Masonry of rough, undressed stones, When only the roughest irregularities are knocked off, it is called scrabbled rubble; when the stones in each course are rudely dressed to nearly a uniform height, ranged rubble.

run (arch.)
That section of construction continuing in a straight line.

run-in
The initial period of operation of any mechanism during which the component parts seat themselves.

run of mine (F.&C.)
Unscreened bituminous coal as it comes from the mine.

running (traveling) block (arch.)
The block attached to the load to be moved for an intermediate moving block.

running or dead end (arch.)
Free end of rope.

rust
A reddish coating that forms on iron as the result of oxidation.

S

saddle board
Boards nailed along the ridge of a roof.

saddle fitting
A fitting clamped to the outside of a pipe, the joint being made tight with a gasket.

saddle valve
A valve clamped to the outside of a pipe.

safe (arch.)
A pan or other collector placed beneath a pipe or fixture to prevent leakage from escaping to the floor, ceiling, or wall.

safe loading capacity
The maximum weight that can be applied with safety; the breaking strength divided by a safety factor for impact, use, wear, and other variables.

safe waste (arch.)
The waste pipe from a safe.

safe working pressure
See design pressure.

sagging
The bending of a body in the middle by its own weight or by the load upon it.

salt-glazed tile
Tile with vitreous glaze on its surface produced by burning salt in the kiln at the temperature used in finishing the burning.

sampling
The removal of a portion of a material for examination or analysis.

sampling action (A.C.)
Is that in which the difference between the set point and the valve of the controlled variable is measured and correction made only at intermittent intervals.

sand trap or sand interceptor
A catch basin for the collection of sand or other gritty material.

sanitary sewer
A sewer for sewage disposal only, as differentiated from a storm sewer, which is intended for rainfall disposal. Also called "domestic sewage."

sapwood (arch.)
The outer, live portion of the wood in a tree. It is usually light in color.

sash
The framework that moves and holds the panes of glass in a window.

sash weight
Metal bar attached to the end of the window sash cord and used to balance the sash.

saturated air
Air which contains the maximum amount of water vapor that it can hold at its temperature and pressure.

saturated steam
Steam at the boiling temperature corresponding to its pressure which has no water particles entrained in it. Any further addition of heat will cause its temperature to rise.

saturated water
Water at its boiling point.

saturation, magnetic
The condition of a magnetic substance when its magnetism has reached its highest possible value.

saturation temperature
The temperature at which evaporation occurs at a particular pressure.

sawdust
Fine particles of wood refuse from saw mills.

scabble (arch.)
To dress off the rougher projections of stones for rubble masonry. This is usually done with a stone axe or a scabbling hammer.

scalar (E.M.)
A scalar or scalar quantity is a measurement involving only magnitude, i.e. density, weight, volume, etc. It is identified to distinguish it from a vector quantity which has both magnitude and direction.

scale
A hard coating or layer of chemical materials on internal surfaces of boiler pressure parts.

scantling
(1) The width and thickness of a piece of timber.
(2) The studding for a partition, when it is under five inches square.
(3) Small pieces of dimension lumber. The term is often applied to a 2″ x 4″ and 2″ x 6″.

scarfing
Joining and bolting two pieces of timber together transversely so that the two appear to be one.

sconce
A fixed hanging or projecting candlestick.

score
To make notches or incisions along a cutting line.

scoring (arch.)
The grooves formed on a surface to increase the bond of mortar, plaster, or stucco placed over it.

scotch boiler
See under boiler.

scratch coat
The first coat of plaster. It is scratched to afford a bond for the second coat.

screeds
Long, narrow strips of plaster put on horizontally along a wall and carefully faced out of wind. They serve as guides for plastering the wide intervals between them.

screen
(1) A perforated or meshed fabric, usually framed, used to separate fines from coarser parts; a sieve.
(2) Wall or partition which does not reach up to the ceiling.
(3) A perforated covering, as a window screen or a fire screen.

screen analysis
A method of determining the size of dust particles by passing dust through sieves of standard mesh.

screen collector
A collector using screens of cloth or wire to filter out dust.

screen tube
A tube in a water screen.

screenings (F.&C.)
The undersized coal from a screening process. (Often minus ¾″ or smaller—bituminous).

screw feed (F.&C.)
A means of introducing fuel by rotation of a screw.

scribing
Fitting woodwork to an irregular surface.

scrubber
An apparatus for the removal of solids from gases by entrainment in water.

seal
(1) The vertical distance between the dip and the crown weir of a trap. Also, the water in the trap between the dip and the crown weir.
(2) Material used to close openings between structures to prevent leakage. To "seal" an opening.

seal weld
A weld used primarily to obtain tightness and prevent leakage.

seam (F.&C.)
A continuous tabular deposit of vegetal or sedimentary origin bedded between parallel strata of sandstone, shale or clay.

seam (P.P.)
The joint between two plates riveted together.

seating curve (E.M.)
The curve at the bottom of the tooth gap on a roller chain sprocket.

secondary air (F.&C.)
Air for combustion supplied to the furnace to supplement the primary air.

secondary branch (arch.)
Any branch in a building drain other than the primary branch.

secondary combustion (F.&C.)
Combustion which occurs as a result of ignition at a point beyond the furnace. (See also Delayed Combustion.)

secondary furnace
Second in a series of a multi-stage furnace.

secondary hardening (heat treat)
Tempering certain alloy steels at certain temperatures so that the resulting hardness is greater than that obtained by tempering the same steel at some lower temperature for the same time.

secondary treatment (P.P.)
Treatment of boiler feedwater or internal treatment of boilerwater after primary treatment.

section (arch.)
A drawing showing the internal heights of the various parts of a building. It supposes the building to be cut through entirely, so as to show the walls, the heights of the internal doors and other apertures, the heights of the stories, the thicknesses of the floors, etc.

sectional-header boiler
See under boiler.

sectionally-supported wall (P.P.)
A furnace or boiler wall which consists of special refractory blocks or shapes that are mounted on and supported at intervals of height by metallic hangers.

sediment (P.P.)
Matter in water which can be removed from suspension by gravity or mechanical means.

sediment (F.&C.)
A non-combustible solid matter which settles out at bottom of a liquid; a small percentage is present in residual fuel oils.

sedimentation
Particle size determination by settling time in a liquid.

segregation (P.P.)
The tendency of refuse of varying compositions to deposit selectively in different parts of a steam generating unit.

seizing-cord rope
A binding around two or more pieces of rope to hold them together.

seizing-wire rope
A whipping for wire rope, made with annealed wire.

selective heating (heat treat)
Heating only certain portions of an object so that they have the desired properties after cooling.

selective quenching (heat treat)
Quenching only certain portions of an object.

self induction (elect.)
The process by which a circuit induces an EMF in itself by its own magnetic field.

self locking wedge (E.M.)
A wedge so designed that friction will keep it from slipping.

self-operated controller (A.C.)
A controller in which all the energy to operate the final control element is derived from the controlled medium through the primary element. This type of controller must have both self-operated measuring means and self-operated controlling means.

self regulation (A.C.)
Is an inherent characteristic of a process which aids in limiting deviation of the controlled variable.

self-siphonage (P.P.)

The breaking of the seal of a trap as a result of removing the water therefrom by the discharge of the fixture to which the trap is connected.

self-supporting steel stack (P.P.)

A steel stack of sufficient strength to require no lateral support.

semi-anthracite (F.&C.)

A coal classification according to rank. Dry F.C. 86% or more and less than 92% and dry volatile matter 14% or less and more than 8%, on a mineral matter free basis.

semi-automatic welding

Semi-automatic welding is welding wherein the feed of filler metal is automatically controlled, the manipulation of the welding unit being controlled by hand.

semi-bituminous (F.&C.)

A former coal classification according to rank—including low Volatile Bituminous.

semi-fused slag (F.&C.)

Hard slag masses consisting of particles which have partly fused together.

sensitivity

The ratio of output response to a specified change in the input. This term can be applied to any element in the control loop. For a measuring instrument the input is the measured variable; for an automatic controller it is the controlled variable.

For example, an automatic temperature controller having a net output pressure of 15 psi and a full scale range of 0 to 150 F would have a sensitivity of 0.1 psi per degree F.

Where non linear relationships are involved the point or points at which the sensitivity is given should be stated.

Sometimes used synonymously with "responsiveness."

separately-fired heater

Heat transfer apparatus receiving heat from an independently fired furnace.

separation (P.P.)

The removal of dust from a gas stream.

separator

(1) A mechanical device for the removal of slate from coal, or an electromagnetic device for the removal of magnetic ores or tramp iron from coal.

(2) Any device for sorting and dividing one substance from another.

(3) See "collector."

(4) See "interceptor."

series cascade action (A.C.)

The regulation of each of a number of automatic controllers by the action of another automatic controller.

series collection (P.P.)

A combination of two or more collectors arranged to pass the total volume of dust laden gases through first one and then the other.

series connection (elect.)

An arrangement of cells, generators, condensers, or conductors, so that each carries the entire current of the circuit.

series-wound (elect.)

Having the armature wired in series with the field winding. (Applied to motors or generators.)

service box

See "curb" box.

service clamp (P.P.)

A saddlelike connection used on a water main for a service connection. Sometimes called a "pipe saddle."

service ell

A 45° or 90° bend with an outside thread on one end and an inside thread on the other. Also called a "street ell."

service factor (P.P.)

A factor by which the specified horsepower is multiplied to compensate for drive conditions.

service head

A special fitting used where service wires leave the conduit or cable to be attached to power lines; it prevents moisture from entering the conduit or cable.

service pipe

The pipe from the water main or source of supply to the building served.

service tee

A pipe tee with an outside thread on one end and an inside thread on the other end and on the branch.

service water

General purpose water which may or may not have been treated for a special purpose.

servo mechanism (A.C.)

An automatic control system in which the controlled variable is mechanical position.

set point (A.C.)

The position to which the control-point-setting mechanism is set. Where the automatic controller possesses a set-point scale, the set point is the scale reading translated into units of the controlled variable. Where a setting scale is not provided, the set point is the position of the control-point-setting mechanism translated into units of the controlled variable. In some types of automatic controllers, for example, those with two position differential gap, floating with neutral or proportional-position action, the set point is related to the position of a

range of values of the controlled variable. The set point is often selected as the center of this range of values. The set point may be varied manually or by automatic means, such as in time-schedule or ratio control.

setback (arch.)

A flat, plain setoff in a wall. Also, a setting back of the outside wall of a building for some distance from the street.

setoff (arch.)

The horizontal line shown where a wall is reduced in thickness and, consequently, the part of the thicker portion seems to project beyond the thinner. In plinths this is usually simply chamfered. In other parts of the work the setoff is generally concealed by a projecting string.

settling velocities (P.P.)

The velocity at which the dust will fall out of dust laden gas under the influence of gravity only.

sewer

A conduit for carrying off sewage.

sewerage

(n.) The works comprising a sewer system, pumping stations, treatment works, and all other works necessary to the collection, treatment, or disposal of sewage. (adj.) Having to do with the collection, treatment, or disposal of sewage.

shaft

(1) Any open space, other than a court, that extends through a building for two or more stories. It may be interior or exterior, and it may be for air, light, elevator, dumb-waiter or other purposes. A vent-shaft is one used solely to ventilate or light a water-closet compartment, bathroom, or pantry.

(2) Slender columns, standing either alone or in connection with pillars, jambs, vaulting, etc.

shake (arch.)
In the case of wood, a separation along the grain, the greater part of which occurs between the rings of annual growth.

shaking grate (P.P.)
A grate from which refuse is removed by motion of the grate causing the refuse to sift through openings in or between the grate.

shale
A thinly stratified, consolidated, sedimentary clay with well-marked cleavage parallel to the bedding.

shaping
Removing metal by means of a reciprocating ram that holds the tool. On the forward stroke, chips are peeled off of the work held firm to the table. The machine shop and tool room are places the prospective tool designer should become thoroughly acquainted with. By observation and harmonious cooperation with these departments, ideas for efficient tool design may be worked out.

shave hook
A leadworker's tool used for shaving or cutting lead.

sheathing
Boards nailed over rafers or studding to serve as a base for roofing or siding.

sheathing paper
A building material used in wall, floor, and roof construction to resist the passage of air.

sheave
The grooved wheel or pulley of a pulley block.

shed roof or lean-to
A roof having only one set of rafters, falling from a higher to a lower wall, like an aisle roof.

sheet metal working

"Work performed on metal in sheet form." Problems involving a knowledge of geometry, surface development, and metal reaction must be dealt with in this department. They are particularly involved in the designing of tools for sheet metal parts, such as spot and seam welding fixtures; shearing, punching, and forming dies.

shell

(1) The cylindrical portion of a pressure vessel.
(2) The outer walls.

shielded carbon arc welding

Shielded carbon arc welding is a carbon arc-welding process wherein the arc and molten weld metal are protected from the atmosphere by a shielding medium.

shielded metal arc welding

Shielded metal arc welding is a metal arc-welding process wherein the arc and weld metal are protected from the atmosphere by a shielding medium.

shim

A strip of material used to fill a small space.

shiplap

Boards cut along the edge in such a fashion that when nailed alongside one another they form a half-lap joint.

shingles

Roof covering made of wood cut to stock lengths and thicknesses and to random widths.

shoe mold or base shoe (arch.)

A strip of quarter-round that is nailed across the joint between the floor and the baseboard.

shop practice

Deals with the activity carried on within the shop and is governed by such factors as KIND, QUANTITY, and

QUALITY of production. The factors in turn are governed by ORGANIZATION STANDARDS, plus the TYPE and CONDITION equipment.

The prospective tool designer should familiarize himself with the shop practices of those departments which may have a part in building or using the tool which he is to design. Such shop departments are herewith briefly commented on.

shore

A piece of timber placed in an oblique direction to support a building or wall temporarily while it is being repaired or altered.

shoulder

A projecting part.

shoulder nipple

A pipe nipple somewhat longer than a close nipple. It has an unthreaded space of about ¼ in. between the threaded ends.

shredder

A machine for cutting, scraping, or tearing material into shreds.

shrunk joint

A joint made by shrinking a heated piece of pipe over the ends of two cool pipes.

Siamese connection

A wye conection used on fire lines so that two lines of hose may be connected to a hydrant or to the same nozzle.

side air admission (P.P.)

Admission of air to the underside of a grate from the sides of a chain or traveling grate stoker.

side-construction tile

Tile designed to receive its principal stress at right angles to the axes of the cells.

side dump stoker (P.P.)
A stoker so arranged that refuse is discharged from a dump plate at the side of the stoker.

side-outlet ell
An ell with outlet at right angles to plane of run.

side vent
A vent connecting to the drain pipe through a 45° wye.

sidewall water box (P.P.)
A square or rectangular clinker chill.

siding
Boards used as exterior walls.

sieve
A laboratory apparatus with meshes through which the finer particles of a substance are passed to separate them from the coarser particles.

siftings (F.&C.)
Fine particles of solid fuel which sift through a grate.

silex
Finely ground quartz used as a filler.

sill
(1) Those pieces of timber or stone at the bottoms of doors and windows.

(2) The wood portion of a house that rests on the foundations; the timbers on the ground which support the posts and superstructure of a timber building.

sill cock
A faucet used on the outside of a building, to which the garden hose is usually attached. It contains a hose thread rather than a pipe thread on the end of the faucet.

silt

Finely divided anthracite obtained as a residue from cleaning process.

single cascade action (A.C.)

Is the regulation of the set point on one automatic controller by the action of another automatic controller. Time program control does not constitute a closed loop unless time is affected by feedback.

single-cut sprocket (E.M.)

For double-pitch roller chains, a sprocket having one set of effective teeth.

single retort stoker (P.P.)

An underfeed stoker using one retort only in the assembly of a complete stoker. A single furnace may contain one or more single retort stokers.

single-speed floating action (A.C.)

Is that in which a final control element is moved at a single speed. See floating action.

single-stage furnace

A furnace consisting of one combustion chamber.

sink

A shallow fixture, ordinarily with a flat bottom, that is usually used in a kitchen or in connection with the preparation of food, for laboratory purposes, and for certain industrial processes. There are many types of special sinks the purpose of which is indicated by the name prefixed before the word sink, such as "slop sink, vegetable sink," etc.

sinuous header (P.P.)

A header of a sectional header type boiler in which the sides are curved back and forth to suit the stagger of the boiler tubes connected to the header faces.

siphonage
A suction created by the flow of liquids in pipes. A pressure less than atmospheric.

sitz bath
Same as "bidet."

size
Glue, varnish, shellac, etc. used to seal pores of material to be painted.

sizing (arch.)
A coating applied to plaster or wallboard before paint or paste is put on, to prevent uneven absorption.

skew-back
A refractory block having an inclined face to receive the thrust of a sprung or segmental arch.

skimmer cyclone (P.P.)
The cyclone with an arrangement at its inner periphery for skimming off dust which is more or less concentrated at that point.

skintled brickwork
Irregularly formed brickwork arranged with variations in projections on the outside face-wall. It is usually made of irregularly shaped bricks.

skirting
Trim used between floor and walls; the narrow boards that form a plinth around the margin of a floor. More often called baseboard.

slack (F.&C.)
Screenings, or fine coal; maximum top size seldom above 2½".

slacking (F.&C.)
Breaking down of friable coals due to changes in moisture contents.

slag
Molten or fused refuse.

slag blower
A soot blower usually of the retractable type for removing slag from heat absorbing surfaces by blowing the surfaces.

slag screen
See "furnace slag screen."

slag spout
The extension trough through which molten ash flows from the furnace.

slag tap furnace
A pulverized-fuel fired furnace in which the ash particles are deposited and retained on the floor thereof in molten condition, and from which the molten ash is removed by tapping either continuously or intermittenly.

slag tapping
The removal of molten slag from a furnace either intermittenly or continuously.

slant (arch).
A branch connection from a house sewer to a common sewer. See also "house slant."

slate (F.&C.)
A rock formation sometimes overlaying or mixed with a coal seam. In connection with anthracite coal, any material which has less than 40% fixed carbon.

sleeper (arch.)
A piece of timber laid on the ground to receive floor joists.

sleeve (P.P.)
A cylindrical tube surrounding a pipe or shaft.

sleeve
A tubular member through a wall to permit passage of pipe or other connections.

slenderness ratio (E.M.)
The ratio of the length of a uniform column to the least radius of gyration of the cross section.

slip joint
A connection in which one pipe slides into another. The joint is made tight with approved gasket, packing, or calking.

slip seal
A seal between members designed to permit movement of either member by slipping or sliding.

slop sink
A deeper fixture than an ordinary sink; it is used for the receipt of slops.

sludge
A soft water-formed sedimentary deposit which normally can be removed by blowing down.

slug
A large "dose" of chemical treatment applied internally to a steam boiler intermittently. Also used sometimes instead of "priming" to denote a discharge of water out through a boiler steam outlet in relatively large intermittent amounts.

slug
A slug is that mass to which a force of one pound imparts an acceleration of one foot per second squared.

sluice (P.P.)
See ash sluice.

small knot (arch.)
A knot in wood over ½", but not over ¾" in diameter.

smoke
Small gas borne particles of carbon or soot, less than 1 micron in size, resulting from incomplete combustion of carbonaceous materials and of sufficient number to be observable.

smoke chamber
Portion of a fireplace directly over the damper.

snatch block
A single block made so that the shell opens on one side to admit rope.

snowballing (F.&C.)
The matting of pulverized-fuel particles into masses, usually occurring in pulverized-fuel storage bins.

soaking (heat treating)
Prolonged holding at a selected temperature.

socket
See "coupling."

socket (wire rope fittings)
Any attachment fitted to the end of wire rope and held by wedging either by molten metal or other similar arrangements.

socket plug
A plug with a recess in the face, into which a wrench will fit to turn the plug.

soffit
The lower horizontal face of a part or member of a building.

soft water
Water which contains little or no calcium of magnesium salts, or water from which scale forming impurities have been removed or reduced.

softening (P.P.)
The act of reducing scale forming calcium and magnesium impurities from water.

softening temperature (F.&C.)
The temperature at which a standard ash cone fuses down to a spherical mass when heated in accordance with a prescribed procedure.

soil pipe
A pipe through which liquid wastes carrying human excrement may flow. Also, a cast-iron pipe, with bell-and-spigot ends, used in plumbing to convey human excrement or liquid wastes.

soil stack
A vertical soil pipe conveying human excrement and liquid wastes.

solder
An alloy of tin and lead having a low melting point. It is used for joining metals.

soldering iron
A piece of copper, rectangular in shape, and pointed at one end. Used to hold heat as it is applied to the solder.

soldiers
In brickwork, bricks set on edge.

sole or sole plate (arch.)
A horizontal member, usually a 2″ x 4″, on which wall and partition studs rest.

solenoid (elect.)
A coil of wire used to produce a magnetic field.

solution
A liquid, such as boiler water, containing dissolved substances.

solution heat-treatment
Heating an alloy to a suitable temperature, holding at that temperature long enough to allow one or more constituents to enter into solid solution, and then cooling rapidly enough to hold the constituents in solution. The alloy is left in a supersaturated, unstable state and may subsequently exhibit quench aging.

soot
Unburned particles of carbon derived from hydrocarbons.

soot blower
A mechanical device for discharging steam or air to clean heat absorbing surfaces.

sound knot (arch.)
A knot which is solid across its face and which is as hard as the surrounding wood.

sound wood (arch.)
Wood free from any form of decay, incipient or advanced.

space charge (elect.)
The charge acquired by the space inside a vacuum tube due to the presence of electrons.

space force systems
The science dealing with the forces in a non-coplaner system.

space heaters
Small automatic heaters; pipeless furnaces that do not have to be installed in basements.

spaced tube wall (P.P.)
A watertube wall with space between the tubes.

spacers (arch.)
Wood strips used to hold the sides of a concrete form an equal distance apart at various points.

spall (arch.)
(1) Inferior or broken brick;
(2) Stone chips.

spalling (P.P.)
The breaking off of the surface of refractory material as a result of internal stresses.

span (arch.)
The distance between the supports of a beam, girder, arch, truss, etc.

spark advance
In an internal combustion engine spark advance relates to the timing of the ignition. The spark may either be *advanced* or *retarded* depending upon the speed of the engine.

specific gravity
Specific gravity is the ratio of the density (or specific weight) of a substance to that of water. The term "specific gravity" is an exceedingly poor one since gravity has nothing to do with it. "Density ratio" would describe the term more precisely.

specific heat
The quantity of heat, expressed in Btu, required to raise the temperature of 1 lb. of a substance 1° F.

specific weight
Specific weight is the weight per unit volume. In the English system, the unit of specific weight is pounds per cubic foot.

specification
The designation of the kind, quality, and quantity of work and material that are to go into a building, in conjunction with the working drawings.

spectroscopic analysis
Identification of chemical elements by characteristic emission and absorption of light rays.

spheroidizing (heat treat)
Heating and cooling to produce a spheroidal or globular form of carbide in steel.

spigot
The end of a pipe which fits into a bell. Also a word used synonymously with "faucet."

spike knot (arch.)
A knot sawn in a lengthwise direction.

spiral-grained wood (arch.)
Wood in which the fibers take a more or less winding or spiral course, as in a twisted tree. It may be detected on the flat grain surface.

splash plate (P.P.)
An abrasion-resistant metal plate, forming the back of an elbow in a pulverized-fuel-and-air line, against which the fluidized material strikes and is dispersed for the purpose of obtaining uniform distribution in the succeeding line or burner.

splayed
The jamb of a door, or anything else of which one side makes an oblique angle with the other.

splice
To join two ropes together, usually by interlocking or tucking the strands.

splitter (P.P.)
Plates spaced in an elbow of a duct so disposed as to guide the flow of fluid through the elbow with uniform distribution and to minimize pressure drop.

sponge ash

Accumulation of dry ash particles into soft structures having a spongy appearance.

spontaneous combustion

Ignition of combustible material following slow oxidation without the application of high temperature from an external source.

spray angle (F.& C.)

The angle included between the sides of the cone formed by liquid fuel discharged from mechanical, rotary atomizers and by some forms of steam or air atomizers.

spray nozzle (F.&C.)

A nozzle from which a liquid fuel is discharged in the form of a spray.

spray quenching (heat treat)

Quenching in a spray of liquid.

spray tower (P.P.)

A duct through which liquid particles descend countercurrent to a column of gas; a fine spray is used when the object is to concentrate the liquid, a coarse spray when the object is to clean the gas by entrainment of the solid particles in the liquid droplets.

sprayer plate (P.P.)

A metal plate used to atomize the fuel in the atomizer of an oil burner.

spring balance

A spring balance is an instrument used to measure forces. It consists of a coil spring to which is attached a pointer that moves over a scale. The scale is calibrated to read in any desired unit.

sprung arch (arch.)
An arch in the form of a segment of a circle supported by skew backs at the two ends.

spud
A short connecting pipe between the meter and the supply pipe or a similar connection.

spun ends
The ends of hollow members closed by rolling while heated.

s.s. glass
Single-strength glass, used in ordinary window panes.

stabilizing treatment (heat treat)
Any treatment intended to stabilize the structure of an alloy or the dimensions of a part.

(1) Heating austenitic stainless steels that contain titanium, columbium, or tantalum to a suitable temperature below that of a full anneal in order to activate the maximum amount of carbon by precipitation as a carbide of titanium, columbium, or tantalum.

(2) Transforming retained austenite in parts made from tool steel.

(3) Precipitating a constituent from a nonferrous solid solution to improve the workability, to decrease the tendency of certain alloys to age harden at room temperature, or to obtain dimensional stability.

stack (arch.)
A general term used for any vertical line of soil, waste, or vent piping.

stack (P.P.)
A vertical conduit, which due to the difference in density between internal and external gases, creates a draft at its base.

stack draft (P.P.)
The magnitude of the draft measured at inlet to the stack.

stack effect (P.P.)
That portion of a pressure differential resulting from difference in elevation of the points of measurement.

stack effluent (P.P.)
Gas and solid products discharged from stacks.

stack vent
A stack vent is the extension of a soil or waste stack above the highest horizontal drain connected to the stack.

staging (arch.)
A structure of posts and boards for supporting workmen and materials in building.

stagnation
The condition of being free from movement or lacking circulation.

standard air
Dry air weighing 0.075 lb. per cu. ft. at sea level (29.92" barometric pressure) and 70° F.

standard flue gas
Gas weighing 0.078 lb. per cu. ft. at sea level (29.92" barometric pressure) and 70° F.

standing (crown) block
A fixed block.

standing or live end
Whole rope less the running end.

standpipe
A vertical pipe usually used for the storage of water, frequently under pressure.

star valve
See rotary valve.

static efficiency
The mechanical efficiency multiplied by the ratio of static pressure differential to the total pressure differential, from fan inlet to fan outlet.

static equilibrium
Any system at rest or moving at constant velocity.

static pressure
The measure of potential energy of a fluid.

stationary grate (P.P.)
A grate having no moving parts.

stay
A tensile stress member to hold material or other members rigidly in position.

staybolt
A bolt threaded through or welded at each end, into two spaced sheets of a firebox or box header to support flat surfaces against internal pressure.

steam
The vapor phase of water substantially unmixed with other gases.

steam-and-water drum (P.P.)
A pressure chamber located at the upper extremity of a boiler circulatory system in which the steam generated in the boiler is separated from the water and from which steam is discharged at a position above a water level maintained therein.

steam atomizing oil burner
A burner for firing oil which is atomized by steam. It may be of the inside or outside mixing type.

steam binding
A restriction in circulation due to a steam pocket or a rapid steam formation.

steam-cooled wall
A wall partly or completely covered with super-heater or reheater tubes.

steam dome
A receptacle riveted or welded to the top sheet of a fire tube boiler through and from which the steam is taken from the boiler.

steam dryer
See steam scrubber.

steam-free water
Water containing no steam bubbles.

steam gage
A gage for indicating the pressure of steam.

steam generating unit
A unit to which water, fuel, and air are supplied and in which steam is generated. It consists of a boiler furnace, and fuel burning equipment, and may include as component parts water walls, superheater, reheater, economizer, air heater, or any combination thereof.

steam jet blower
A device which utilizes the energy of steam flowing through a nozzle or nozzles to induce a flow of air to be supplied for combustion.

steam jet exhauster
A similar device used to create draft.

steam purity
The degree of contamination. Contamination usually expressed in ppm (parts per million).

steam quality
The percent by weight of vapor in a steam and water mixture.

steam scrubber
A series of screens, wire, or plates through which steam is passed to remove entrained moisture.

steam separator
A device for removing the entrained water from steam.

steam washer
A device in a steam drum in which steam is mixed or brought into contact with water having a lower concentration than boiler water, to reduce the solids concentration in the entrained moisture.

steaming economizer
An economizer so designed that some of the fluid passing through it is evaporated.

stench trap
A flap in a frame, which opens to admit cellar drainage to a sewer and then closes to prevent sewer air from entering the building.

step-down transformer (elect.)
A transformer with fewer turns in the secondary than in the primary.

step-up transformer (elect.)
A transformer with more turns in the secondary than in the primary.

sticky ash
Ash which is at a temperature between initial deformation and softening temperature.

stile
The upright side frames of a panel door.

Stillson wrench
A wrench with slightly curved, serrated jaws designed to

tighten the grip as the handle is turned. The jaws are not replaceable. See pipe wrench.

stilted

Term used to describe anything raised above its usual level.

stock (arch.)

The tool that holds the dies in pipe threading and the threading of bolts, screws, etc.

stocking collector

See bag-type collector.

stoker (P.P.)

See "mechanical stoker."

stoker gate (P.P.)

An element of a stoker, placed at the point of entrance of fuel into the furnace and by means of which the depth of fuel on the stoker grate may be controlled. It is generally used in connection with chain or traveling grate stokers and has the form of a guillotine.

stoker grate (P.P.)

That part of the stoker within the space defined by the walls of the furnace at the fuel bed level, which forms the bottom of the furnace and supports the fuel bed. On a chain or traveling grate stoker, the fuel bed is considered to be supported only to the center line of the rear shaft or its equivalent.

Stoke's law

For particles about 1 to 150 microns, the terminal of settling velocity is proportional to the square of the radius of the particle, the difference of densities of the particle and fluid, acceleration of gravity and the reciprocal of the viscosity of the fluid.

stool (arch.)
The inside sill of a window frame.

stoop (arch.)
A seat before the door; often a porch with a balustrade and seats on the sides.

stop-and-waste cock
A stop cock so designed that when the supply of water is shut off a drain is opened through which the water in the pipe, on the side of the cock on the supply line opposite the source of water, is drained to waste.

stop cock
A valve with a ground key.

storage system (P.P.)
See "bin system."

storm water
That portion of rainfall or other precipitation which runs off over a surface after a storm for a short period following a storm when the flow exceeds the normal runoff.

story
That portion of a building included between the surface of any floor and the surface of the next floor above. If there is no floor above, it is the space between the floor surface and the ceiling or roof above. A half-story is that portion of any building wholly or partly within the roof framing. In some sections, a basement or cellar is considered as a story if its ceiling is more than five feet above grade.

straightedge
A board with a straight side used for measuring and drawing.

straightening vanes
Vanes inserted in gas ducts to direct the flow of gas parallel to the walls.

strain aging (heat treat)
Aging induced by cold working. See aging.

strain
See deformation.

strain rosette (E.M.)
At a point on the surface of a stressed body the strains measured on each of three properly chosen intersecting gauge lines make it possible to calculate the principal stresses at that point. The gauge lines and the corresponding strains are called a *strain rosette*.

strainer
A device, such as a filter, to retain solid particles allowing a liquid to pass.

strand
A part of a cord or wire rope; several yarns or smaller strands twisted together.

strap (arch.)
An iron plate for connecting two or more timbers, to which it is screwed by bolts. It generally passes around one of the timbers.

strap hinge
A heavy hinge used on large doors.

stratification
Non-homogeneity existing transversely in a gas stream.

street ell
Same as "service ell."

strength of materials (E.M.)
Is the study of the material properties of a structural member which enables us to design the member and investigate the internal stresses and deformations set up as a result of the external forces applied.

strength weld
A weld capable of withstanding a design stress.

stress (E.M.)
The intensity of force, expressed as units of weight per unit of area. (A force of 10 pounds acting on 2 square inches of area is equivalent to a stress of 10/2 or 5 pounds per square inch.) See unit stress.

stress raiser
Any irregularity that causes a stress concentration.

stress relieving (heat treat)
Heating to a suitable temperature, holding long enough to reduce residual stresses and then cooling slowly enough to minimize the development of new residual stresses.

stress-strain diagram; stress (E.M.)
The curve obtained by plotting the unit stress on a body as the ordinate against the corresponding unit strain as the abscissa.

stretcher (arch.)
A brick or block of masonry laid lengthwise in a wall.

string-course (arch.)
A narrow, vertically faced, slightly projecting course in an elevation. If window sills are made continuous, they form a string-course; but if this course is made thicker or deeper than ordinary window sills, or covers a set-off in the wall, it becomes a blocking-course.

string piece (arch.)
The piece of board put under the treads and risers to form the support of the stair.

stringboard (arch.)
A board placed next to the well-hole in wooden stairs, terminating the end of the steps.

stringers (arch.)
The sides of a flight of stairs. Also called carriages.

struck joint (arch.)
A mortar joint used in brickwork.

structural clay tile (arch.)
Hollow burned-clay masonry building units with parallel cells. The term "tile" is understood, to mean "structural clay tile." The term "terra cotta," which is applied to ornamental building units of burned clay, should not be used to designate structural clay tile.

structural timber (arch.)
By the term "Structural Timber" is understood such products of wood in which the strength of the timber is the controlling element in its selection and use, such as trestle timbers (stringers, caps, posts, mud sills, bracings, bridge ties, guard rails); car timbers (car framing, including upper framing, car sills); framing for buildings (posts, mud sills, girders, framing joists); ship timbers (ship timbers, ship decking); and cross arm for poles.

strut (arch.)
Timber used as a brace or support, such as framing.

stub tube (P.P.)
A short tube welded to a pressure part for field extension.

stucco (arch.)
Any material used to cover walls and the like, put on wet and drying hard and durable. Plaster, when applied to walls in the usual way, is a kind of stucco; the hard finish is almost exactly like fine Roman stucco except that it is applied in one thin coat instead of many. The term is commonly used for outer walls. The practical value of stucco is very great, this material being almost impervious to water. An excellent wall three or more stories high can be built with eight inches of brick on the inner side, four inches of brick on the outer side,

an air space of two or four inches across which the outer and inner walls are well tied, and two coats of well-mixed and well-laid stucco on the exterior. The stucco is finally painted with oil paint.

stud (P.P.)
A projecting pin serving as a support or means of attachment.

stud plate (P.P.)
A small steel plate welded to a tube to support refractory.

stud tube (P.P.)
A tube having short studs welded to it.

stud-tube wall (P.P.)
A wall containing water tubes covered with refractory which is held in place by stud anchors attached to the tubes.

studs or studding (arch.)
The small timbers used in partitions and outside wooden walls, to which the laths and boards are nailed. The uprights of a wall. The 2″ x 4″ stock used to frame the sides of a building.

sub-bituminous coal (F.&C.)
Coal classification according to rank:
(a) Moist Btu 11,000 or more and less than 13,000.
(b) Moist Btu 9500 or more and less than 11,000.
(c) Moist Btu 8500 or more and less than 9500.

sub-floor (arch.)
The rough floor under the finish floor.

suction system pulverizer (P.P.)
A pulverizer in which the internal pressure is below atmospheric. It is generally located on the inlet of the primary air exhauster.

sulphate-carbonate ratio
The proportion of sulphates to carbonates, or alkalinity

expressed as carbonates, in boiler water. The proper maintenance of this ratio has been advocated as a means of inhibiting caustic embittlement.

summation action (A.C.)

Is the coupling of one automatic controller primary feedback with another or with other automatic controller actuating signals to function as the algebraic sum of the combination. Special cases are cutback, limiting, overriding and certain types of proportioning action.

summer (arch.)

A girder or main-beam of a floor. If supported on two-story posts and open below, it is called a brace-summer.

sump

A pit or receptacle at a low point to which liquid wastes are drained.

superheat

To raise the temperature of steam above its saturation temperature. The temperature in excess of its saturation temperature.

superheat control

Regulating of vapor temperature over a range of operating conditions.

superheater

A group of tubes which absorb heat from the products of combustion to raise the temperature of the vapor passing through the tubes above the temperature corresponding to its pressure.

(a) *Convection Superheater*—A superheater so arranged and located to absorb heat from the products of combustion mainly by convection.

(b) *Radiant Superheater*—A superheater so arranged and located to absorb heat mainly by radiation.

superheater outlet pressure
The steam pressure of the point where it leaves the superheater.

supply tube (P.P.)
A tube which carries water to the inlet water header.

surface blowoff (P.P.)
Removal of water, foam, etc. from the surface at the water level in a boiler. The equipment for such removal.

surface check
A check occurring at the surface of a piece.

surface clay
An unconsolidated, unstratified clay, occurring on the surface.

surface combustion (F.&C.)
The non-luminous burning of a combustible gaseous mixture close to the surface of a hot porous refractory material through which it has passed.

surface lumber
Lumber that has been dressed.

surface moisture (F.&C.)
That portion of the moisture in the coal which comes from external sources as water seepage, rain, snow, condensation, etc.

surface water (arch.)
(1) The water carried by the aggregate in concrete except that held by absorption within the aggregate particles themselves.

(2) That portion of a rainfall or other precipitation which runs off over the surface of the ground.

surge (P.P.)
The sudden displacement or movement of water in a closed vessel or drum.

suspended arch (P.P.)
An arch in which the refractory blocks or shapes are suspended by metallic hangers.

suspended solids
Undissolved solids in water or other liquids.

suspended wall
Same as sectionally supported wall.

suspension, center of (E.M.)
The point from which a compound pendulum or similar device is suspended.

swage
To increase or decrease in diameter by means of swages, swedges, press forging, or spinning.

sweat (P.P.)
The condensation of moisture from a warm saturated atmosphere on a cooler surface. A slight weep in a boiler joint but not in sufficient amount to form drops.

sweat joint
A soldered joint heated by a flame instead of a soldering iron.

sweating (P.P.)
The appearance of condensed moisture from the air on a surface. The term is used also to indicate the soldering, welding, or brazing of metals.

swedge
Same as "swage."

sweep fitting (P.P.)
A fitting with a long-radius curve.

swell (P.P.)
The sudden increase in the volume of the steam in the water steam mixture below the water level.

swing joint
A joint in a threaded pipe line permitting motion in the line in a plane normal to the direction of one part of the line.

swinging load
A load that changes at relatively short intervals.

swivel joint
Same as "swing joint."

T

T-hinge
A hinge shaped like the letter T.

T-joint (arch.)
A joint shaped like the letter T.

tackle (arch.)
An assembly of ropes and blocks.

tail beam (arch.)
A relatively short beam or joist supported in a wall on one end and by a header on the other.

tail trimmer (arch.)
A trimmer next to the wall, into which the ends of joists are fastened to avoid fires.

take-up (E.M.)
See chain take-up.

tamp (arch.)
To pound earth down firmly.

tampion (P.P.)
A leadworker's tool of boxwood, shaped like a top, and used for swedging out the end of a lead pipe.

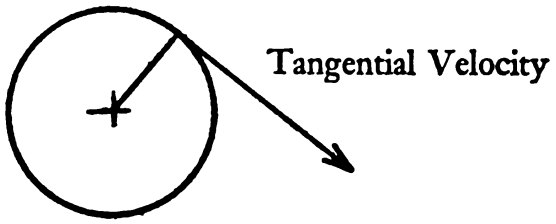
tanbark (F.&C.)
Fibrous portion of ground oak or hemlock used in tanning. Spent tanbark is used as fuel.

tang
Portion of metal tool that fits into handle.

tangent tube wall
See tube-to-tube wall.

tangential firing (P.P.)
A method of firing by which a number of burners are so located in the furnace walls that the center lines of the burners are tangential to an imaginary circle. Corner firing is usually included in this type.

tangential velocity (E.M.)
is the velocity of a point on a rotating body which is tangent to the circle of rotation and perpendicular to the radius at that point.



tap
(1) A tool used for cutting inside threads. Also, to bore a hole into a pipe, tank, or other device. Also, synonymous with "faucet."
(2) (P.P.) The action of removing molten slag from a slag-tap furnace through a tap hole.

tap hole (P.P.)
An opening for the removal of slag from a slag tap furnace.

taper-lock sprocket (E.M.)
A sprocket with a split tapered bushing for rigid mounting on a shaft.

tapped tee (P.P.)
A cast-iron bell-end tee with the branch tapped to receive a threaded pipe or fitting.

telescopic blower

A long retractable soot blower with element made up of two or more sections which telescope mechanically.

temper brittleness (heat treat)

Brittleness that results when certain steels are held within, or are cooled slowly through, a certain range of temperature below the transformation range. The brittleness is revealed by notched-bar impact tests at or below room temperature.

tempering (heat treat)

Reheating a quench-hardened or normalized ferrous alloy to a temperature below the transformation range and then cooling at any rate desired.

tempering air

Air at a lower temperature added to a stream of preheated air to modify its temperature.

tempering moisture (F.&C.)

Water added to certain coals which, as received, have insufficient moisture content for proper combustion on stokers.

template

A pattern cut out of paper, cardboard, or a similar material. Also, a short piece of timber put under a girder or other beam for added strength. A beam over an opening, such as a doorway.

tenon

Tongue or lip cut on a piece of wood to fit into a mortice.

tension (E.M.)

Tension is the state of being extended longitudinally. When a force tends to stretch a body we say that it is in tension.

tension linkage (E.M.)

A chain application in which linear motion is not continuous in direction.

terneplate
Sheet iron or steel coated with an alloy of approximately 4 parts of lead to 1 part of tin.

terra cotta
Baked clay of a fine quality. Used for architectural ornaments, statues, vases, etc.

tertiary air (F.&C.)
Air for combustion supplied to the furnace to supplement the primary and secondary air.

test block fan requirements
The operating conditions for which a fan is designed which are to be proven by test, following the procedure outlined by the Test Code of the National Association of Fan Manufacturers.

theoretical air (F.&C.)
The quantity of air required for perfect combustion.

theoretical draft (P.P.)
The draft which would be available at the base of a stack if there were no friction or acccleration losses in the stack.

theoretical flame temperature
Same as adiabatic temperature.

therm
A unit of heat applied especially to gas. One therm = 100,000 Btu.

thermal probe (P.P.)
A liquid cooled tube used as a calorimeter in a furnace to measure heat absorption rates.

thermal sleeve (P.P.)
A spaced internal sleeve lining of a connection for introducing a fluid of one temperature into a vessel containing

fluid at a subsantially different temperature, used to avoid abnormal strains.

thermocouple
A pair of metals which generate an electro-motive-force (emf) by the heating of one of the junctions; it is used to measure temperature differences.

thickness
That dimension designed to lie at right angles to the face of the wall, floor, or other member in which it is used.

thimble (P.P.)
A small thimble-like filter made of porous material used for obtaining a sample of dust from a gas stream.
(arch.) A short piece of pipe or tube.

threshold (arch.)
A piece of wood or metal under a door.

threshold sensitivity (A.C.)
The lowest level of the measured variable which produces effective response of the instrument or automatic controller.

throat (arch.)
(1) Opening at top of fireplace into chimney where damper is located.
(2) A channel or groove made on the under side of a string-course, coping, etc. to prevent water from running inward toward the walls.

throat
A neck portion of a passageway.

through check (arch.)
A check extending through the piece from the surface to an opposite or to an adjoining surface.

through shake (arch.)
A shake which extends between any two faces of a timber.

through stay (P.P.)
A brace used in fire-tube boilers between the heads or tube sheets.

tie (arch.)
A timber, rod, chain, etc., which binds together two bodies that have a tendency to separate or diverge from one another. The TIE-BEAM connects the bottom of a pair of principal rafters and prevents them from bursting out the walls.

tie bar (P.P.)
A structural member designed to maintain the spacing of furnace waterwall tubes.

tie plate (P.P.)
A plate, through which a bolt or tie rod is passed, to hold brick in place.

tie rod
A tension member between buckstays or tie plates.

tight knot (arch.)
A knot so fixed by growth or position that it will firmly retain its place in the piece.

tile
A preformed, burned refractory, usually applied to shapes other than standard brick.

tile baffle
A baffle formed of preformed burned refractory shapes.

tiles
Flat pieces of clay burned in kilns, used in place of slates or lead to cover roofs. Also used for floors and wainscoting, about fireplaces, etc. Small squares of marble are also called tiles. Tiles are also made of plastic or metal and often used in these forms to cover walls.

time quenching (heat treat)
Interrupted quenching in which the duration of holding in the quenching medium is controlled.

tin snips
Shears used for cutting thin metal.

toenail (arch.)
To drive a nail in at an angle in order to permit it to penetrate a second member. This makes a stronger joint than does driving the nail straight down.

tongue (arch.)
The part of a board left projecting so that it can be inserted into a groove.

tooth flange thickness (E.M.)
The width in profile of a sprocket tooth.

tooth form (E.M.)
The shape of the working surface of a sprocket tooth.

tooth gap (E.M.)
The space between two sprocket teeth.

tooth profile (E.M.)
The outline of a sprocket tooth as projected on a plane through the sprocket axis and the center of the tooth.

topping curve (E.M.)
The curve of the outer portion of the tooth form. It is shaped to guide the roller smoothly into mesh with the sprocket.

torching (P.P.)
The rapid burning of combustible material deposited on or near boiler-unit heating surfaces.

torque
See moment—moment of a force.

torsional center (E.M.)

That point on a member undergoing a torsional stress which does not move as the member twists is called the torsional center of that section. Other names for it are *center of twist*, *center of torsion*, and *center of shear*.

total air (F.&C.)

The total quantity of air supplied to the fuel and products of combustion. Per cent total air is the ratio of total air to theoretical air, expressed as per cent.

total moisture (F.&C.)

The sum of inherent moisture and surface moisture in coal.

total pressure

The sum of the static and velocity pressures.

total solids concentration (P.P.)

The weight of dissolved and suspended impurities in a unit weight of boiler water, usually expressed in ppm. (parts per million).

trajectory (E.M.)

Trajectory is the path followed by a projected body. The path of a projectile such as a ball, a bomb, or a bullet is called its trajectory.

transformation ranges or transformation temperature ranges (heat treat)

Those ranges of temperature within which austenite forms during heating and transforms during cooling. The two ranges are distinct, sometimes overlapping but never coinciding. The limiting temperatures of the ranges depend on the composition of the alloy and on the rate of change of temperature, particularly during cooling.

transformer (elect.)

A device that, without moving parts, transfers electrical

energy from one circuit to another circuit by the air of electromagnetic induction.

transmissibility, principle of (E.M.)

When a body is acted upon by a force, the external effect is the same regardless of the point of application along its line of action.

transom

(1) The horizontal construction that divides a window into heights or stages.

(2) A window which is built above a door or other window and is attached to a transom.

(3) Horizontal spar.

transport system (P.P.)

The pump and piping, blow tank and piping, or screw conveyor, used to transport the pulverized fuel from the cyclone to the pulverized-fuel bin in Storage Systems.

transverse pitch (E.M.)

The lateral distance between the center lines of each strand of a multiple strand chain, or between the tooth profiles on a sprocket for a multiple-strand roller chain.

trap

(1) (arch.) A fitting or device so constructed as to prevent the passage of air, gas, and some vermin through a pipe without materially affecting the flow of sewage or waste water through it.

(2) A receptacle for the collection of undesirable material, as a pyrites trap in a pulverizer.

trap seal

See "seal."

traveling grate stoker (P.P.)

A stoker similar to a chain gratestoker with the exception that the grate is separate from but is supported on and driven

by chains. Only enough chain strands are used as may be required to support and drive the grate.

traverse (arch.)
To plane in a direction across the grain of the wood, as to traverse a floor by planning across the boards.

tray (arch.)
A fixture used in a laundry for washing; sometimes called a "laundry tub."

tread (arch.)
The horizontal part of a step of a stair.

treated water (P.P.)
Water which has been chemically treated to make it suitable for boiler feed.

trellis (arch.)
Latticework of metal or wood for vines to run on.

trestle
A movable frame or support for anything. When made of cross-piece with four legs, it is called a horse.

trim (arch.)
(1) The finish materials in a building, such as moldings applied around openings (window trim, door trim) or at the floor and ceiling of rooms (baseboard, cornice, picture molding).

(2) Of a door, sometimes used to denote the locks, knobs, and hinges.

trimmer (arch.)
The beam or floor joist to which a header is nailed in the framing for either a chimney, a stairway, or other opening.

trimmer arch
An arch built in front of a fireplace, in the thickness of the floor, between two trimmers. The bottom of the arch starts from the chimney and the top presses against the header.

trimo wrench
Same as "Stillson wrench."

triode (elect.)
A vacuum tube containing a filament, grid, and plate.

tube
A hollow cylinder for conveying fluids.

tube cleaner
A device for cleaning tubes by brushing, hammering, or by rotating cutters.

tube door (P.P.)
A door in a boiler or furnace wall through which tubes may be removed or new tubes passed.

tube hole (P.P.)
A hole in a drum, header, or tube sheet to accommodate a tube.

tube plug (P.P.)
A solid plug driven into the end of a tube.

tube seat (P.P.)
That part of a tube hole with which a tube makes contact.

tube sheet (P.P.)
The plate containing the tube holes.

tube-to-tube (P.P.)
A waterwall in which the tubes are substantially tangent to each other with practically no space between the tubes.

tube turbining (P.P.)
The act of cleaning by means of a power driven rotary device which passes through the tube.

tubular heater (P.P.)
See air heater.

tubular-type collector (P.P.)
A collector utilizing a number of essentially straight-walled cyclone tubes in parallel.

tuck-pointing
Marking the joints of brickwork with a narrow, parallel ridge of fine putty.

tucker fitting
A cast-iron coupling, one opening of which is threaded for screw pipe and the other opening of which has a hub to receive the spigot end of a pipe.

turbidity
The optical obstruction to the passing of a ray of light through a body of water, caused by finely divided suspended matter.

turbulent burner (P.P.)
A burner in which fuel and air are mixed and discharged into the furnace in such a manner as to produce turbulent flow from the burner.

turpentine, gum
Liquid used in painting. The distilled gum from yellow pine trees.

turpentine, wood
Liquid extracted from pine wood waste by distillation or by solvents.

tuyeres (P.P.)
Forms of grates, located adjacent to a retort, through which air is introduced.

twin setting (P.P.)
Two boilers arranged with a common furnace.

two-drum economizer (P.P.)
An economizer having two drums connected by tubes.

two-position action (A.C.)

Is that in which a final control element is moved from one of two fixed positions to the other.

two-position differential-gap action (A.C.)

Is that in which a final control element is moved from one of two fixed positions to the other when the controlled variable reaches a predetermined value from one direction, and subsequently is moved to the first position only after the variable has passed in the opposite direction through a range of values to a second predetermined value.

two-position single-point action (A.C.)

That in which a final control element is moved from one of two fixed positions to the other at a single value of the controlled variable. The differential gap of this type of two-position action is zero.

two-stage furnace (P.P.)

A multi-stage furnace consisting of a primary and a secondary furnace only.

U

ultimate analysis
See analysis, ultimate.

ultimate elongation (E.M.)
The permanent deformation remaining after tensile rupture as a percentage of an arbitrary length including the section of rupture.

ultimate strength (E.M.)
The maximum tensile, compressive, or shear stress that a material can sustain. Usually the condition of stress is uniaxial tension, uniaxial compression, or pure shear.

unaccounted-for loss (P.P.)
The portion of a boiler heat balance which represents the difference between 100 per cent and the sum of the heat absorbed by the unit and all the classified losses expressed as per cent.

unburned combustible (F.&C.)
The combustible portion of the fuel which is not completely oxidized.

unburned combustible loss (F.&C.)
See combustible loss.

underchaining (E.M.)
A drive is underchained when it incorporates a chain of substantially lower rating than that indicated by normal selection procedures.

unfired pressure vessel (P.P.)
A vessel designed to withstand internal pressure, neither

subjected to heat from products of combustion nor an integral part of a fired pressure vessel system.

unidirectional (elect.)
As applied to a current of electricity, a current that flows in one direction only.

union (arch.)
A pipe fitting used for joining the ends of two pipes neither of which can be turned. There are two kinds of unions (see "box union and flange union").

union coupling (arch.)
A right- and left-hand threaded turnbuckle or sleeve nut used to join or draw two pipes together.

union vent (arch.)
A dual vent or unit vent.

unit
A standard of measurement such as inch, foot, centimeter, etc. In measuring a physical quantity, the first step usually consists of choosing a *unit* of that quantity. Hence a unit may be defined as a single one of a group used as a basis for counting.

unit of run (arch.)
The unit of measurement used with a framing square for measuring rafters.

unit of span
Twice the unit of run.

unit strain (E.M.)
The elongation per unit length of a tensile stressed specimen. The shortening per unit length of a compressed specimen is called *unit compressive strain. Unit shear strain* is the change in the angle (radians) made by two lines on the specimen originally at right angles to each other.

unit stress (E.M.)
The tensile, compressive, or shear stress on a specimen per unit of area in the plane of stress. In general stress means unit stress.

unit system (P.P.)
See "direct-fired system."

unit vent (arch.)
An arrangement of venting so installed that one vent pipe will serve two traps.

unlay (arch.)
To separate or untwist the strands of rope (wire or cord).

upright (arch.)
Vertical spar.

upset
To thicken and shorten, as by hammering a heated bar of iron on the end.

use factor
The ratio of hours in operation to the total hours in that period.

useful limit point (E.M.)
See apparent elastic limit.

V

V-type stoker (P.P.)
See mechanical stoker.

vacuum
An air pressure less than atmospheric. Also, siphonage.

vacuum dust unloader
A suction system used for conveying dust from various points to an accumulation point.

vacuum tube (elect.)
A tube from which the air has been pumped out. The tube contains an element that emits electrons when properly excited and an electrode to attract the electrons and set up a current in an external circuit.

valley (arch.)
The internal angle formed by two inclined sides of a roof.

valley rafter (arch.)
A rafter that forms the intersection of an internal roof angle.

valve
A device used for controlling the flow of liquid or gas in a line of pipe.

vane (P.P.)
A fixed or adjustable plate inserted in a gas or air stream used to change the direction of flow.

vane control (P.P.)
A set of movable vanes in the inlet of a fan to provide regulation of air flow.

vane guide (P.P.)
A set of stationary vanes to govern direction, velocity and distribution of air or gas flow.

vapor
The gaseous product of evaporation.

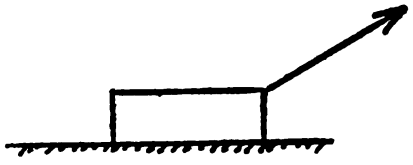
vapor generator
A container of liquid, other than water, which is vaporized by the absorption of heat.

vaporization
The process of producing a vapor phase, usually by the addition of heat, from the liquid or solid phase.

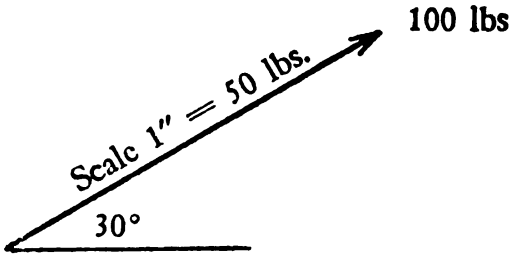
Varignon's theorem (E.M.)
The moment of a force is equal to the sum of the moments of its components.

vector (E.M.)
A vector is a quantity involving both magnitude and direction. In engineering and physics it is usually used as an adjective in front of the word quantity. Hence we get the term a *vector quantity* or vectorial quantity as it should be called.

A vector is used to graphically represent a quantity of measurement. For example, assume we are to slide a block along the floor by pulling with a string as shown in the figure. In order to depict this force properly we must give the magnitude, let us say 100 pounds; and the direction, say 30 degrees above the horizontal to the right. The vector may now be represented by a line drawn to some convenient scale.

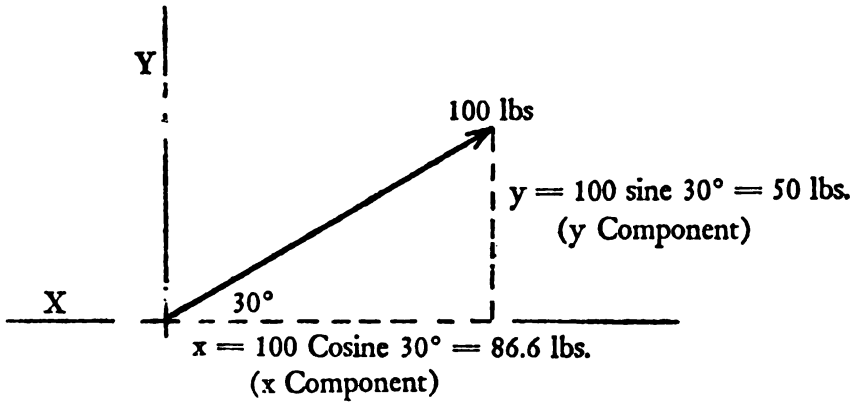


Force is not the only quantity for which we must give magnitude and direction. Velocity and acceleration are two more vector quantities.



Components of a vector

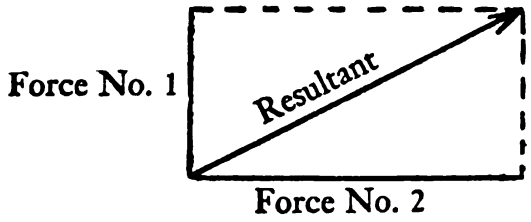
The components of a vector are usually given in the rectangular coordinate system. This can be done either graphically by projection, or analytically by using the trigonometric functions. The illustration will illucidate.

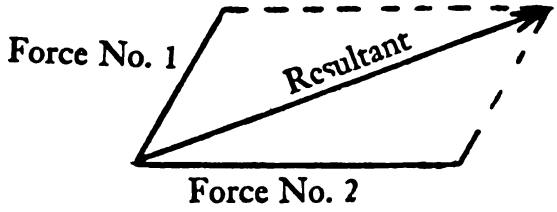


When this is done we say that we have resolved the vector into its X and Y components.

Composition of vectors

The process of combining a set of concurrent forces and finding the *resultant* is called the composition of forces. This is the reverse process of finding the components of a vector.





Vector addition

See composition of vectors.

Vector analysis

Vector analysis is the mathematical study of the properties and application of vectors.

vehicle (arch.)

In painting, the liquid with which the paint pigment is mixed so that it can be brushed on a surface.

vein (F.&C.)

A non-sedimentary deposit disseminated through a rocky mass filling crevices in the earth.

velocity

Velocity is the ratio of displacement of a body to the elapsed time for the displacement.

velocity pressure
The measure of the kinetic energy of a moving fluid.

veneer
A thin layer of wood glued to a base made of a cheaper or inferior wood.

vent
An opening in a vessel or other enclosed space for the removal of gas or vapor.

vented air
The air or gas vented from a Storage System.

verge (arch.)
The edge of the tiling, slate, or shingles projecting over the gable of a roof, that on the horizontal portion being called eaves.

verge board
The board under the edge of gables. Also called a barge board.

vermiculated
Stones and other materials that have been worked so as to have the appearance of being worm-eaten.

vermiculite (arch.)
A plaster insulating material.

vertical
Perpendicular to the earth's surface when we consider the earth's surface a flat plane.

vertical firing (P.P.)
An arrangement of a burner such that air and fuel are discharged into the furnace, in practically a vertical direction.

vertical pipe (P.P.)
Any pipe or fitting that is installed in a vertical position or that makes an angle of not more than 60° with the vertical.

vertical shear (E.M.)
At any cross section of a beam in static equilibrium the resultant external vertical forces acting on one side of the section is equal and opposite to the resultant external forces acting on the other side of the section. These forces tend to shear the beam vertically along the section. The value of either resultant is a measure of the shearing tendency and is known as the vertical shear at that section undergoing analysis.

viscosity
Measure of the internal friction of a fluid or its resistance to flow.

vitreous slag
Glassy slag.

vitrified soil pipe
Hard-baked clay pipe used for outside sewer lines.

volatile matter (F.&C.)
Those products given off by a material as gas or vapor, determined by definite prescribed methods.

volatilization
See vaporization.

volt (elect.)
The practical unit of electrical pressure.

volume of air (P.P.)
The number of cu. ft. of air per minute expressed at fan outlet conditions.

volumeter
A type of flush valve.

vortex
The swirling motion of a liquid in a vessel at the entrance to a discharge nozzle.

vortex eliminator
Baffles, screens or plates designed to prevent the formation of a free vortex.

W

wainscoting (arch.)
Wooden lining of the lower portion of an interior wall, generally in panel form.

wall, bearing (arch.)
A wall which supports any vertical load other than its own weight. It may support joists, beams, girders, or the trusses of a floor.

wall, curtain (arch.)
An enclosing wall, built and supported between columns and piers, which sustains no weight other than its own.

wall, division (arch.)
A bearing wall which runs between two exterior walls and subdivides the building into several parts.

wall, exterior
An outside wall that serves as a vertical enclosure of a building.

wall, fire (arch.)
A wall of solid masonry or reinforced concrete which subdivides a building to restrict the spread of fire and which starts at the foundation and extends continuously through all stories to and above the roof.

wall, fire division (arch.)
This is the same as a fire wall, except that it is not necessarily continuous through all stories and it does not necessarily extend beyond the roof.

wall, foundation
That portion of an enclosing wall below the first tier of floor-joists or beams nearest to and above the grade-line, and that portion of any interior wall or pier below the basement or cellar-floor.

wall, non-bearing
A wall designed to carry only its own weight.

wall, partition
See partition.

wall, party
A wall that is used jointly by two buildings.

wall, plates
Pieces of timber placed on top of brick or stone walls in order to support the roof of a building.

wall, retaining
A wall designed to resist lateral pressure. It may resist the lateral pressure of either the adjoining earth or internal loads.

wall blower (P.P.)
A short retractable blower for cleaning by mass blowing of adjacent wall heat absorbing surfaces.

wall box (P.P.)
A structure in a wall of a steam generator through which apparatus, such as sootblowers, extend into the setting.

wall thickness
The minimum thickness required by a building code for the walls between the floors and the ceiling or roof of a structure.

wallboard
Wood pulp, gypsum, or a similar material made into large, rigid sheets that can be fastened to the frame of a building to provide a surface finish.

wane (arch.)
The natural curvature of a log or of the edge of a board sawed from an unsquared log.

warped
Twisted out of shape by seasoning.

washed sizes (F.&C.)
Sizes of coal which have been washed.

washer (F.&C.)
An apparatus utilizing water (or other liquid media) for the removal of inorganic extraneous matter from coal or for the removal of solids from gases.

washer (P.P.)
An annular ring threaded on the inside to be used as a lock nut. A smooth, flat annular ring placed under a nut or bolt head to fill space or to protect the material under the nut or bolt. A flat annular ring of soft material used in valves to prevent leakage.

washing (F.&C.)
The cleaning of external heat absorbing surfaces with water.

washing (slag action)
The corrosive action of molten slag.

waste fuel
Any by-product fuel that is waste from a manufacturing process.

waste heat
Sensible heat in non-combustible gases, such as gases leaving furnaces used for processing metals, ores or other materials.

waste pipe
A pipe used to convey liquid wastes not containing human excrement.

waste stack

A vertical pipe used to convey liquid wastes not containing human excrement.

water

A liquid composed of two parts of hydrogen and sixteen parts oxygen by weight.

water back (P.P.)

One or more horizontal water tubes located over and laterally across the ash discharge end of a stoker to prevent ash adhesion to the wall and to reduce air leakage from the ashpit into the furnace.

water back or water front (arch.)

A small tank forming a portion of the lining of the firepot in a kitchen range or other small stove or furnace.

water closet

A water-flushed plumbing fixture designed to receive human excrement directly from the user of the fixture. The term may sometimes be used to designate the room or compartment in which the fixture is placed.

water column (P.P.)

A vertical tubular member connected at its top and bottom to the steam and water space respectively of a boiler, to which the water gage, gage cocks, and high and low level alarms may be connected.

water cooled baffle (P.P.)

The baffle composed essentially of closely spaced boiler tubes.

water cooled stoker (P.P.)

A stoker having tubes in or near the grate surface through which water is passed for cooling the grates.

water-cooled wall (P.P.)

A furnace wall containing water tubes.

water gage (P.P.)
The gage glass and its fittings for attachment.

water gas
Gaseous fuel consisting primarily of carbon monoxide and hydrogen made by the interaction of steam and incandescent carbon.

water hammer (P.P.)
A sudden increase in pressure of water due to an instantaneous conversion of momentum to pressure.

water leg (P.P.)
A vertical or nearly vertical box header, sectional header, or water cooled sides of an internal firebox composed of flat or circular surfaces.

water level (P.P.)
The elevation of the surface of the water in a boiler.

water screen (P.P.)
A screen formed by one or more rows of water tubes spaced above the bottom of a pulverized fuel furnace and serving to create an ash cooling zone.

water seal (P.P.)
A seal against leakage of air into a furnace consisting of a metal sheet, the lower edge of which is submerged in trough containing water.

water-soak (or stain) (arch.)
A term applied to a generally water-soaked area in heartwood, which is usually interpreted as the incipient stage of certain wood decays. It occurs in hemlock and possibly in other woods.

water table (arch.)
A molding or slight projection on the outside of a wall. It usually occurs a few feet above the ground, and it serves as a protection against rain.

water tube (P.P.)
A tube in a boiler having the water and steam on the inside and heat applied to the outside.

water vapor
A synonym for steam, usually used to denote steam of low absolute pressure.

watt
A unit of energy in the mks system which is equal to one joule per second. In the study of electricity it is defined as the power required to supply a current of one ampere at a potential drop of one volt.

Watt-hour is a rate of expending power. One watt-hour is equal to the work done when one watt of work is delivered for one hour.

wattmeter
An instrument for measuring electric power in watts.

wavy-grained wood (arch.)
Wood in which the fibers collectively take the form of waves or undulations. It may appear on either the radial or flat-grain surface and is indicated by the wavy surface of a split piece.

weather boarding
Boards lapped over each other to prevent rain from passing through.

weathering (arch.)
A slight fall on the tops of cornices, window sills, etc. to throw off the rain.

weathering (F.&C.)
Same as slacking.

wedge
Any longitudinally inclined block of metal or wood used

as a mechanical advantage for lifting or holding a large weight.

weep (P.P.)

A term usually applied to a minute leak in a boiler joint which forms droplets (or tears) of water very slowly.

weep hole (arch.)

A small hole in a masonry wall. Its function is to permit water to drain through.

weight

The gravitational pull on a body—see pound.

weld

A weld is a localized consolidation of metals by a welding process.

weld metal

Weld metal is the metal resulting from the fusion of the base metal or the base metal and the filler metal.

welding

Uniting by hammering, or by fusion, or two pieces of metal. Welding may be divided into categories: (a) PRESSURE processes (forge and resistance welding), (b) FUSION processes (arc, gas, and Thermit welding.)

In many instances, in tool designing, welded constructions are used instead of castings. The choice is governed by (a) availability of a pattern shop, (b) time and cost of making pattern compared with the welded construction, (c) availability of materials, (d) case of machining, (e) number of like parts to be produced, and (f) policy of the company. If welding is necessary in tool construction, arc welding is usually resorted to, since it causes least distortion. Jigs and fixtures for welding (seam or spot, arc or gas) production parts, constitute a large part of the tool designer's program.

wet-bottom furnaces
See slag-tap furnace.

wet-bulb temperature
The lowest temperature which a water wetted body will attain when exposed to an air current. This is the temperature of adiabatic saturation.

wet steam
Steam containing moisture or water droplets.

wet vent
That portion of a vent pipe through which liquid wastes flow.

wet-wall construction
See dry-wall construction.

wetness or quality
A term used to designate the percentage of water in steam. Also used to describe the presence of a water film on heating surface interiors.

wetting
The process of supplying a water film to the water side of a heating surface.

whipping
A binding on the end of cord rope to prevent unlaying.

white lead
A paint pigment.

whole depth (E.M.)
Radial dimension between top of tooth and root circle—also known as total depth.

wicker or porcupine (wire rope)
A broken wire in a strand of wire rope.

wide range mechanical atomizing oil burner
A burner having an oil atomizer with a range of flow

rates greater than that obtainable with the usual mechanical atomizers.

width
That dimension measured at right angles to the direction of its thickness and length.

wind (arch.)
A turn or a bend. A wall is said to be out of the wind when it is a perfectly flat surface.

windbox (P.P.)
A chamber below the grate or surrounding a burner, through which air under pressure is supplied for combustion of the fuel.

wind box pressure (P.P.)
The static pressure in the windbox of a burner or stoker.

window frame
The portion of the window that holds the sashes.

window sill
The bottom of a window frame.

wing back blocks (P.P.)
Metallic blocks attached to the back side of waterwall tubes to form a furnace wall enclosure.

withes
The partition between two chimney flues in the same stack.

wood
The substance of trees.

work
Work is defined as the product of a force acting on a body and the displacement of the body in the direction of the force. It should be stated that work only occurs when there is a transfer of energy from one system to another.

Thus work in the physical sense can only exist as energy in transition. The mathematical expression for work is:

$$Wk = \int_{t_1}^{t_2} \mathbf{F} \, \delta S$$

working depth (E.M.)

Depth to which a tooth extends into the tooth space of a mating gear when the center distance is standard—equals twice the addendum.

working stress

See allowable stress.

wrapper sheet (P.P.)

The outside plate enclosing the firebox in a firebox or locomotive boiler. Also the thinner sheet in the shell of a two thickness boiler drum.

wristpin

The pin which holds the connecting to the piston in a reciprocating, internal combustion engine.

Y

yarn
A number of cordage fibers twisted together; similar to binder twine.

yarning iron
A calking tool similar to a cold chisel except that the plane of the point of the chisel is offset about 1 in. from the plane of the handle.

yield point (E.M.)
The lowest stress at which the strain increases without any increase in stress.

yield strength (E.M.)
The lowest unit stress at which a material exhibits a specified limiting permanent set. This is a good measure of the useful limit of materials.

yoke (arch.)
The collar by which a lead trap is secured to its support. Also, a pipe with two branches uniting them to form one stream. Also, a vertical connection between a branch waste line or wet vent, a continuous vent stack.

yoke vent (arch.)
A vertical or 45° relief vent of the continuous waste-and-vent type formed by the extension of an upright wye branch or 45° wye-branch inlet of the horizontal branch to the stack. It becomes a dual yoke vent when two horizontal branches are thus vented by the same relief vent.

Z

zone control (P.P.)
The control of air flow into individual zones of a stoker.

zones (P.P.)
Divisions of the stoker windbox in which air can be maintained at different and controllable pressures.

Conversion Factors

	Multiplication Factor	*Result*
Amperes	0.10	Abamperes
Amperes	3×10^{-9}	Statamperes
Atmospheres	29.92	Inches of Mercury
Atmospheres	33.90	Feet of Water
Atmospheres	14.69	Pounds per Square Inch
British Thermal Units	778.30	Foot-Pounds
British Thermal Units	3.93×10^{-4}	Horsepower-Hours
British Thermal Units	1055.00	Joules
British Thermal Units	25.20×10^{-2}	Kilogram-Calories
British Thermal Units	107.60	Kilogram-Meters
British Thermal Units	293.00×10^{-2}	Kilowatt Hours
BTU per Minute	129.7×10^{-1}	Foot-Pounds per Second
BTU per Minute	23.57×10^{-3}	Horsepower
BTU per Minute	17.58×10^{-3}	Kilowatts
BTU per Minute	17.58	Watts

Centimeters	32.81×10^{-3}	Feet
Centimeters	39.37×10^{-2}	Inches
Centimeters	0.01	Meters
Centimeters	62.14×10^{-7}	Miles
Centimeters	10	Millimeters
Circular Mils	50.67×10^{-7}	Square Centimeters
Circular Mils	78.54×10^{-8}	Square Inches
Circular Mils	78.54×10^{-2}	Square Mils
Cubic Centimeters	35.31×10^{4}	Cubic Feet
Cubic Centimeters	61.02×10^{-1}	Cubic Inches
Cubic Centimeters	10^{-6}	Cubic Meters
Cubic Centimeters	13.08×10^{-5}	Cubic Yards
Cubic Centimeters	26.42×10^{-3}	Gallons
Cubic Centimeters	10^{-3}	Liters
Cubic Centimeters	21.13×10^{-2}	Pints (liq.)
Cubic Centimeters	10.57×10^{-2}	Quarts (liq.)
Cubic Feet	28.32×10^{3}	Cubic Centimeters
Cubic Feet	17.28×10^{2}	Cubic Inches
Cubic Feet	28.32×10^{-3}	Cubic Meters
Cubic Feet	37.04×10^{-3}	Cubic Yards
Cubic Feet	7.48	Gallons
Cubic Feet	28.32	Liters
Cubic Feet	59.84	Pints (liq.)
Cubic Feet	29.92	Quarts (liq.)
Cubic Feet per Minute	472.0	Cubic Cms. per Sec.
Cubic Feet per Minute	12.47×10^{-2}	Gallons per Second
Cubic Feet per Minute	47.20×10^{-2}	Liters per Second
Cubic Feet per Minute	62.4	Pounds of Water per Minute

Cubic Inches	16.39	Cubic Centimeters
Cubic Inches	57.87×10^{-3}	Cubic Feet
Cubic Inches	16.39×10^{-4}	Cubic Meters
Cubic Inches	21.43×10^{-4}	Cubic Yards
Cubic Inches	43.29×10^{-2}	Gallons
Cubic Inches	16.39×10^{-1}	Liters
Cubic Inches	10.61×10^{4}	Mil-Feet
Cubic Inches	34.63×10^{-3}	Pints (liq.)
Cubic Inches	17.32×10^{-3}	Quarts (liq.)
Cubic Meters	10^{6}	Cubic Centimeters
Cubic Meters	35.31	Cubic Feet
Cubic Meters	61.02×10^{3}	Cubic Inches
Cubic Meters	13.08×10^{-1}	Cubic Yards
Cubic Meters	264.2	Galons
Cubic Meters	10^{3}	Liters
Cubic Meters	21.13×10^{2}	Pints (liq.)
Cubic Meters	10.57×10^{2}	Quarts (liq.)
Cubic Yards	76.46×10^{4}	Cubic Centimeters
Cubic Yards	27.0	Cubic Feet
Cubic Yards	46.66×10^{3}	Cubic Inches
Cubic Yards	76.46×10^{-2}	Cubic Meters
Cubic Yards	202.0	Gallons
Cubic Yards	764.6	Liters
Cubic Yards	16.16×10^{2}	Pints (liq.)
Cubic Yards	807.9	Quarts (liq.)
Cubic Yards per Minute	45.0×10^{-2}	Cubic Feet per Second
Cubic Yards per Minute	3.37	Gallons per Second
Cubic Yards per Minute	12.74	Liters per Second

Days	24	Hours
Days	14.40×10^{2}	Minutes
Days	86.4×10^{3}	Seconds
Degrees (angle)	60	Minutes
Degrees (angle)	17.45×10^{-3}	Radians
Degrees (angle)	36.0×10^{2}	Seconds
Dynes	10.20×10^{-4}	Grams
Dynes	72.33×10^{-6}	Poundals
Dynes	24.48×10^{-7}	Pounds
Ergs	94.8×10^{-12}	B.T.U.
Ergs	1	Dyne-Centimeters
Ergs	73.78×10^{-9}	Foot Pounds
Ergs	10.20×10^{-4}	Gram-Centimeters
Ergs	10^{-7}	Joules
Ergs	23.89×10^{-12}	Kilogram-Calories
Ergs	10.20×10^{-9}	Kilogram-Meters
Ergs per Second	56.88×10^{-10}	B.T.U. per Minute
Ergs per Second	44.27×10^{-7}	Foot Pounds per Minute
Ergs per Second	73.78×10^{-9}	Foot Pounds per Second
Ergs per Second	13.41×10^{-11}	Horsepower
Ergs per Second	14.33×10^{-10}	Kg.-Calories per Minute
Ergs per Second	10^{-10}	Kilowatts
Farads	10^{-9}	Abfarads
Farads	10^{6}	Microfarads
Farads	9×10^{11}	Statfarads
Fathoms	6	Feet

Feet	30.48	Centimeters
Feet	12	Inches
Feet	30.48×10^{-2}	Meters
Feet	18.94×10^{-5}	Miles
Feet	⅓	Yards
Feet of Water (pressure)	29.50×10^{-3}	Atmospheres
Feet of Water (pressure)	88.26×10^{-2}	Inches of Mercury
Feet of Water (pressure)	304.8	Kgs. per Square Meter
Feet of Water (pressure)	62.43	Pounds per Square Foot
Feet of Water (pressure)	43.35×10^{-2}	Pounds per Square Inch
Feet per Minute	50.80×10^{-2}	Centimeters per Second
Feet per Minute	16.67×10^{-3}	Feet per Second
Feet per Minute	18.29×10^{-3}	Kilometers per Hour
Feet per Minute	30.48×10^{-2}	Meters per Minute
Feet per Minute	11.36×10^{-3}	Miles per Hour
Feet per Second	10.97×10^{-1}	Kilometers per Hour
Feet per Second	59.21×10^{-2}	Knots per Hour
Feet per Second	18.29	Meters per Minute
Feet per Second	68.18×10^{-2}	Miles per Hour
Feet per Second	11.36×10^{-3}	Miles per Minute
Foot Pounds	12.85×10^{-4}	B.T.U.
Foot Pounds	13.56×10^{6}	Ergs
Foot Pounds	50.50×10^{-8}	Horsepower-Hours

Foot Pounds	1.356	Joules
Foot Pounds	32.38×10^{-5}	Kilogram-Calories
Foot Pounds	13.83×10^{-2}	Kilogram-Meters
Foot Pounds	37.66×10^{-8}	Kilowatt-Hours
Foot-Pounds per Minute	12.85×10^{-4}	B.T.U. per Minute
Foot-Pounds per Minute	16.67×10^{-3}	Foot Pounds per Second
Foot-Pounds per Minute	30.30×10^{-6}	Horsepower
Foot-Pounds per Minute	32.38×10^{-5}	Kg-Calories per Minute
Foot-Pounds per Minute	22.60×10^{-6}	Kilowatts
Foot-Pounds per Second	77.09×10^{-3}	B.T.U. per Minute
Foot-Pounds per Second	18.18×10^{-4}	Horsepower
Foot-Pounds per Second	19.43×10^{-3}	Kg-Calories per Minute
Foot-Pounds per Second	13.56×10^{-4}	Kilowatts
Gallons	37.85×10^{2}	Cubic Centimeters
Gallons	13.37×10^{-2}	Cubic Feet
Gallons	231	Cubic Inches
Gallons	37.85×10^{-4}	Cubic Meters
Gallons	49.51×10^{-4}	Cubic Yards
Gallons	3.79	Liters
Gallons	8.0	Pints (liq.)
Gallons	4.0	Quarts (liq.)
Gallons per Minute	22.28×10^{-4}	Cubic Feet per Second
Gallons per Minute	63.08×10^{-3}	Liters per Second

Gausses	6.45	Lines per Square Inch
Grains	64.80×10^{-3}	Grams
Grains	41.67×10^{-3}	Pennyweights (troy)
Grams	980.7	Dynes
Grams	15.43	Grains
Grams	10^{-3}	Kilograms
Grams	10^{3}	Milligrams
Grams	35.27×10^{-3}	Ounces
Grams	32.15×10^{-3}	Ounces (troy)
Grams	70.93×10^{-3}	Poundals
Grams	22.05×10^{-4}	Pounds
Gram-Calories (IT)	39.68×10^{-4}	B.T.U.
Gram-Centimeters	92.97×10^{-9}	B.T.U.
Gram-Centimeters	980.7	Ergs
Gram-Centimeters	72.35×10^{-6}	Foot-Pounds
Gram-Centimeters	98.07×10^{-6}	Joules
Gram-Centimeters	23.43×10^{-9}	Kilogram-Calories
Gram-Centimeters	10^{-5}	Kilogram-Meters
Grams per Cm.	56.00×10^{-4}	Pounds per Inch
Grams per Cu. Cm.	62.43	Pounds per Cubic Foot
Grams per Cu. Cm.	36.13×10^{-3}	Pounds per Cubic Inch
Grams per Cu. Cm.	34.05×10^{-8}	Pounds per Mil-Foot
Horsepower	42.40	B.T.U. per Minute
Horsepower	33,000	Foot-Pounds per Minute

Horsepower	550	Foot-Pounds per Second
Horsepower	1.014	Horsepower (Metric)
Horsepower	10.68	Kg-Calories per Minute
Horsepower	74.57×10^{-2}	Kilowatts
Horsepower	745.7	Watts
Horsepower (boiler)	33.52	Kilowatts
Horsepower (boiler)	9.804	B.T.U. per Hour
Horsepower-Hours	25.44×10^{2}	B.T.U.
Horsepower-Hours	19.8×10^{5}	Foot-Pounds
Horsepower-Hours	26.84×10^{5}	Joules
Horsepower-Hours	641.1	Kilogram-Calories
Horsepower-Hours	27.37×10^{4}	Kilogram-Meters
Horsepower-Hours	74.55×10^{-2}	Kilowatt-Hours
Hours	41.67×10^{-3}	Days
Hours	60	Minutes
Hours	36.00×10^{2}	Seconds
Hours	59.52×10^{-4}	Weeks
Inches	2.54	Centimeters
Inches	83.33×10^{-3}	Feet
Inches	15.78×10^{-6}	Miles
Inches	10^{3}	Mils
Inches	27.78×10^{-3}	Yards
Inches of Mercury	33.42×10^{-3}	Atmospheres
Inches of Mercury	1.133	Feet of Water
Inches of Mercury	345.3	Kilograms per Square Meter

Inches of Mercury	49.12×10^{-2}	Pounds per Square Inch
Inches of Mercury	70.73	Pounds per Square Foot
Inches of Water	24.58×10^{-4}	Atmospheres
Inches of Water	73.55×10^{-3}	Inches of Mercury
Inches of Water	25.40	Kgs. per Square Meter
Inches of Water	57.81×10^{-2}	Ounces per Square Inch
Inches of Water	5.20	Pounds per Square Foot
Inches of Water	36.13×10^{-3}	Pounds per Square Inch
Joules (Int.)	94.80×10^{-5}	B.T.U.
Joules (Int.)	10^7	Ergs
Joules (Int.)	73.78×10^{-2}	Foot-Pounds
Joules (Int.)	23.89×10^{-5}	Kilogram-Calories
Joules (Int.)	10.20×10^{-2}	Kilogram Meters
Joules (Int.)	27.78×10^{-5}	Watt-Hours
Kilograms	98.07×10^4	Dynes
Kilograms	10^3	Grams
Kilograms	70.93	Poundals
Kilograms	2.21	Pounds
Kilograms	11.02×10^{-4}	Tons (short)
Kilogram-Calories	39.68×10^{-1}	B.T.U.
Kilogram-Calories	30.88×10^2	Foot-Pounds
Kilogram-Calories	15.60×10^{-4}	Horsepower-Hours
Kilogram-Calories	41.86×10^2	Joules
Kilogram-Calories	427.0	Kilogram-Meters
Kilogram-Calories	11.63×10^{-4}	Kilowatt-Hours

Kilogram-Calories per Minute	51.47	Foot-Pounds per Second
Kilogram-Calories per Minute	93.58×10^{-3}	Horsepower
Kilogram-Calories per Minute	69.77×10^{-3}	Kilowatts
Kgs.-Cms. Squared	23.73×10^{-4}	Pound-Feet Squared
Kgs.-Cms. Squared	34.17×10^{-2}	Pound-Inches Squared
Kilogram Meters	92.94×10^{-4}	B.T.U.
Kilogram Meters	98.04×10^{6}	Ergs
Kilogram Meters	7.233	Foot-Pounds
Kilogram Meters	9.804	Joules
Kilogram Meters	23.42×10^{-4}	Kilogram-Calories
Kilogram Meters	27.23×10^{-7}	Kilowatt Hours
Kilograms per Cubic Meter	10^{-3}	Grams per Cubic Cm.
Kilograms per Cubic Meter	62.43×10^{-3}	Pounds per Cubic Foot
Kilograms per Cubic Meter	36.13×10^{-6}	Pounds per Cubic Inch
Kilograms per Cubic Meter	34.05×10^{-11}	Pounds per Mil Foot
Kilograms per Meter	67.20×10^{-2}	Pounds per Foot
Kilograms per Square Meter	96.78×10^{-6}	Atmospheres
Kilograms per Square Meter	98.07×10^{-6}	Bars
Kilograms per Square Meter	32.81×10^{-4}	Feet of Water

Kilograms per Square Meter	28.96×10^{-3}	Inches of Mercury
Kilograms per Square Meter	20.48×10^{-2}	Pounds per Square Inch
Kilograms per Square Meter	14.22×10^{-4}	Pounds per Square Foot
Kilometers	10^{5}	Centimeters
Kilometers	32.81×10^{2}	Feet
Kilometers	39.37×10^{3}	Inches
Kilometers	10^{3}	Meters
Kilometers	62.14×10^{-2}	Miles
Kilometers	10.94×10^{2}	Yards
Kilometers per Hour	27.78	Centimeters per Second
Kilometers per Hour	54.68	Feet per Minute
Kilometers per Hour	91.13×10^{-2}	Feet per Second
Kilometers per Hour	53.96×10^{-2}	Knots per Hour
Kilometers per Hour	16.67	Meters per Minute
Kilometers per Hour	62.14×10^{-2}	Miles per Hour
Kilowatts	56.88	B.T.U. per Minute
Kilowatts	44.27×10^{3}	Foot-Pounds per Minute
Kilowatts	737.8	Foot-Pounds per Second
Kilowatts	1.341	Horsepower
Kilowatts	14.33	Kg-Calories per Minute
Kilowatts	10^{3}	Watts

Kilowatt Hours	34.13×10^2	B.T.U.
Kilowatt Hours	26.56×10^5	Foot-Pounds
Kilowatt Hours	1.341	Horsepower-Hours
Kilowatt Hours	36.00×10^5	Joules
Kilowatt Hours	860.0	Kilogram-Calories
Kilowatt Hours	36.72×10^4	Kilogram-Meters
Knots	60.80×10^2	Feet
Knots	1.853	Kilometers
Knots	1.152	Miles
Knots	20.27×10^2	Yards
Knots per Hour	51.48	Centimeters per Second
Knots per Hour	1.689	Feet per Second
Knots per Hour	1.853	Kilometers per Hour
Knots per Hour	1.152	Miles per Hour
Liters	10^3	Cubic Centimeters
Liters	35.31×10^{-3}	Cubic Feet
Liters	61.02	Cubic Inches
Liters	10^{-3}	Cubic Meters
Liters	13.08×10^{-4}	Cubic Yards
Liters	26.42×10^{-2}	Gallons
Liters	2.113	Pints (liq.)
Liters	1.057	Quarts (liq.)
Liters per Minute	58.85×10^{-5}	Cubic Feet per Second
Liters per Minute	44.03×10^{-4}	Gallons per Second
Log_{10} N	2.303	Log_e N or Ln N
Log_e N or Ln N	43.43×10^{-2}	Log_{10} N

Lumens per Square Foot	1	Foot Candles
Maxwells	10^{-3}	Kilolines
Megalines	10^{6}	Maxwells
Meters	100	Centimeters
Meters	3.281	Feet
Meters	39.37	Inches
Meters	10^{-3}	Kilometers
Meters	62.14×10^{-5}	Miles
Meters	10^{3}	Millimeters
Meters	1.094	Yards
Meter-Kilograms	98.07×10^{6}	Centimeter-Dynes
Meter-Kilograms	10^{5}	Centimeter-Grams
Meter-Kilograms	7.233	Pound-Feet
Meters per Minute	1.667	Centimeters per Second
Meters per Minute	3.281	Feet per Minute
Meters per Minute	54.68×10^{-3}	Feet per Second
Meters per Minute	6.0×10^{-2}	Kilometers per Hour
Meters per Minute	37.28×10^{-3}	Miles per Hour
Meters per Second	196.8	Feet per Minute
Meters per Second	3.281	Feet per Second
Meters per Second	3.6	Kilometers per Hour
Meters per Second	6.0×10^{-2}	Kilometers per Hour
Meters per Second	2.237	Miles per Hour
Meters per Second	37.28×10^{-3}	Miles per Minute

Microfarads	10^{-15}	Abfarads
Microfarads	10^{-6}	Farads
Microfarads	9×10^{5}	Statfarads
Micrograms	10^{-6}	Grams
Miles	16.09×10^{4}	Centimeters
Miles	52.80×10^{2}	Feet
Miles	63.36×10^{3}	Inches
Miles	1.609	Kilometers
Miles	17.60×10^{2}	Yards
Miles per Hour	44.70	Centimeters per Second
Miles per Hour	88	Feet per Minute
Miles per Hour	1.467	Feet per Second
Miles per Hour	1.609	Kilometers per Hour
Miles per Hour	86.84×10^{-2}	Knots per Hour
Miles per Hour	26.82	Meters per Minute
Miles per Minute	26.82×10^{2}	Centimeters per Second
Miles per Minute	88	Feet per Second
Miles per Minute	1.609	Kilometers per Minute
Miles per Minute	86.84×10^{-2}	Knots per Minute
Miles per Minute	60	Miles per Hour
Millimeters	0.10	Centimeters
Millimeters	32.81×10^{-4}	Feet
Millimeters	39.37×10^{-3}	Inches
Millimeters	62.14×10^{-8}	Miles
Millimeters	39.37	Mils
Millimeters	10.94×10^{-4}	Yards

Mils	25.40×10^{-4}	Centimeters
Mils	83.33×10^{-6}	Feet
Mils	10^{-3}	Inches
Mils	25.40×10^{-9}	Kilometers
Mils	27.78×10^{-6}	Yards
Minutes	69.44×10^{-5}	Days
Minutes	16.67×10^{-3}	Hours
Minutes	99.21×10^{-6}	Weeks
Minutes (angle)	29.09×10^{-5}	Radians
Minutes (angle)	60	Seconds (angle)
Months	30.42	Days
Months	730	Hours
Months	43.80	Minutes
Months	26.28×10^{5}	Seconds
Ohms	10^{9}	Abohms
Ohms	10^{-6}	Megohms
Ohms	10^{6}	Microhms
Ohms	$1/9 \times 10^{-11}$	Statohms
Ounces	16	Drams
Ounces	437.5	Grains
Ounces	28.35	Grams
Ounces	6.25×10^{-2}	Pounds
Ounces (fluid)	1.805	Cubic Inches
Ounces (fluid)	29.57×10^{-3}	Liters
Ounces (troy)	480	Grains
Ounces (troy)	31.10	Grams
Ounces (troy)	20	Pennyweights (troy)
Ounces (troy)	83.33×10^{-3}	Pounds (troy)

Pints (dry)	**33.60**	**Cubic Inches**
Pints (liq.)	473.2	Cubic Centimeters
Pints (liq.)	16.71×10^{-3}	Cubic Feet
Pints (liq.)	28.87	Cubic Inches
Pints (liq.)	47.32×10^{-3}	Cubic Meters
Pints (liq.)	61.89×10^{-3}	Cubic Yards
Pints (liq.)	12.50×10^{-2}	Gallons
Pints (liq.)	47.32×10^{-2}	Liters
Poundals	13.83×10^{3}	Dynes
Poundals	14.10	Grams
Poundals	31.08×10^{-3}	Pounds
Pounds	44.48×10^{4}	Dynes
Pounds	70×10^{2}	Grains
Pounds	453.6	Grams
Pounds	16	Ounces
Pounds	32.17	Poundals
Pounds (troy)	82.29×10^{-2}	Pounds (av.)
Pound-Feet	13.56×10^{6}	Centimeter-Dynes
Pound-Feet	13.83×10^{3}	Centimeter-Grams
Pound-Feet	13.83×10^{-2}	Meter-Kilograms
Pounds of Water	16.02×10^{-3}	Cubic Feet
Pounds of Water	27.68	Cubic Inches
Pounds of Water	11.98×10^{-2}	Gallons
Pounds per Cubic Foot	16.02×10^{-3}	Grams per Cubic Cm.
Pounds per Cubic Foot	16.02	Kgs. per Cubic Meter

Pounds per Cubic Foot	57.87×10^{-6}	Pounds per Cubic Inch
Pounds per Cubic Foot	54.56×10^{-10}	Pounds per Mil Foot
Pounds per Cubic Inch	27.68	Grams per Cubic Centimeter
Pounds per Cubic Inch	27.68×10^{3}	Kgs. per Cubic Meter
Pounds per Cubic Inch	17.28×10^{2}	Pounds per Cubic Foot
Pounds per Cubic Inch	94.25×10^{-7}	Pounds per Mil Foot
Pounds per Square Foot	47.25×10^{-5}	Atmospheres
Pounds per Square Foot	16.02×10^{-3}	Feet of Water
Pounds per Square Foot	14.14×10^{-3}	Inches of Mercury
Pounds per Square Foot	4.882	Kgs. per Square Meter
Pounds per Square Foot	69.44×10^{-4}	Pounds per Square Inch
Pounds per Square Inch	68.04×10^{-3}	Atmospheres
Pounds per Square Inch	2.307	Feet of Water
Pounds per Square Inch	2.036	Inches of Mercury
Pounds per Square Inch	703.1	Kgs. per Square Meter
Pounds per Square Inch	144	Pounds per Square Foot

Quarts (dry)	67.20	Cubic Inches
Quarts (liquid)	946.4	Cubic Centimeters
Quarts (liquid)	33.42×10^{-3}	Cubic Feet
Quarts (liquid)	57.75	Cubic Inches
Quarts (liquid)	94.64×10^{-5}	Cubic Meters
Quarts (liquid)	12.38×10^{-4}	Cubic Yards
Quarts (liquid)	25.0×10^{-2}	Gallons
Quarts (liquid)	94.63×10^{-2}	Liters
Radians	57.30	Degrees
Radians	34.38×10^{2}	Minutes
Radians	63.66×10^{-2}	Quadrants
Radians per Second	57.30	Degrees per Second
Radians per Second	9.549	Revolutions per Minute
Radians per Second	15.92×10^{-2}	Revolutions per Second
Revolutions	360	Degrees
Revolutions	4.00	Quadrants
Revolutions	6.283	Radians
Revolutions per Minute	6.00	Degrees per Second
Revolutions per Minute	10.47×10^{-2}	Radians per Second
Revolutions per Minute	16.67×10^{-3}	Revolutions per Second
Revolutions per Second	360	Degrees per Second
Revolutions per Second	6.283	Radians per Second
Revolutions per Second	60	Revolutions per Minute

Seconds	11.57×10^{-6}	Days
Seconds	27.78×10^{-5}	Hours
Seconds	16.67×10^{-3}	Minutes
Seconds	16.54×10^{-7}	Weeks
Square Centimeters	19.73×10^{4}	Circular Mils
Square Centimeters	10.76×10^{-4}	Square Feet
Square Centimeters	15.50×10^{-2}	Square Inches
Square Centimeters	10^{-4}	Square Meters
Square Centimeters	38.61×10^{-11}	Square Miles
Square Centimeters	100	Square Millimeters
Square Centimeters	11.96×10^{-5}	Square Yards
Square Feet	22.96×10^{-6}	Acres
Square Feet	18.33×10^{7}	Circular Mils
Square Feet	929.0	Square Centimeters
Square Feet	144.0	Square Inches
Square Feet	92.90×10^{-3}	Square Meters
Square Feet	35.87×10^{-9}	Square Miles
Square Feet	11.11×10^{-2}	Square Yards
Square Inches	12.73×10^{5}	Circular Mils
Square Inches	6.452	Square Centimeters
Square Inches	69.44×10^{-4}	Square Feet
Square Inches	6.452×10^{-2}	Square Millimeters
Square Inches	10^{6}	Square Mils
Square Inches	77.16×10^{-5}	Square Yards
Square Kilometers	247.1	Acres
Square Kilometers	10.76×10^{6}	Square Feet
Square Kilometers	15.50×10^{8}	Square Inches
Square Kilometers	10^{6}	Square Meters
Square Kilometers	38.61×10^{-2}	Square Miles
Square Kilometers	11.96×10^{5}	Square Yards

Square Meters	24.71×10^{-5}	Acres
Square Meters	10.76	Square Feet
Square Meters	15.50×10^{-2}	Square Inches
Square Meters	38.61×10^{-8}	Square Miles
Square Meters	1.196	Square Yards
Square Miles	640	Acres
Square Miles	27.88×10^{6}	Square Feet
Square Miles	2.59	Square Kilometers
Square Miles	30.98×10^{5}	Square Yards
Square Millimeters	19.73×10^{2}	Circular Mils
Square Millimeters	0.01	Square Centimeters
Square Millimeters	15.50×10^{-4}	Square Inches
Square Mils	1.273	Circular Mils
Square Mils	64.52×10^{-7}	Square Centimeters
Square Mils	10^{-6}	Square Inches
Square Yards	20.66×10^{-4}	Acres
Square Yards	9	Square Feet
Square Yards	12.96×10^{2}	Square Inches
Square Yards	83.61×10^{-2}	Square Meters
Square Yards	32.28×10^{-8}	Square Miles
Temp. (degs. Cent.) +273	1	Abs. Temp. (degs. Kelvin)
Temp. (degs. Cent.) +17.8	1.8	Temp. (degs. Fahr.)
Temp. (degs. Fahr.) +460	1	Abs. Temp. (degs. Rankin)
Temp. (degs. Fahr.) −32	55.56×10^{-2}	Temp. (degs. Cent.)

Tons (long)	10.16×10^{3}	Kilograms
Tons (long)	22.42×10^{3}	Pounds
Tons (metric)	10^{3}	Kilograms
Tons (metric)	22.05×10^{3}	Pounds
Tons (short)	907.2	Kilograms
Tons (short)	20.00×10^{3}	Pounds
Volts	10^{8}	Abvolts
Volts	33.33×10^{-4}	Statvolts
Watts	56.88×10^{-3}	B.T.U. per Minute
Watts	10^{7}	Ergs per Second
Watts	44.27	Foot-Pounds per Minute
Watts	73.78×10^{-2}	Foot-Pounds per Second
Watts	13.41×10^{-4}	Horsepower
Watts	14.33×10^{-3}	Kg-Calories per Minute
Watts	10^{-3}	Kilowatts
Watt-Hours	3.413	B.T.U.
Watt-Hours	26.56×10^{3}	Foot-Pounds
Watt-Hours	13.41×10^{-4}	Horsepower-Hours
Watt-Hours	86.00×10^{-2}	Kilogram-Calories
Watt-Hours	367.2	Kilogram Meters
Watt-Hours	10^{-3}	Kilowatt-Hours
Weeks	168	Hours
Weeks	10.08×10^{3}	Minutes
Weeks	60.48×10^{4}	Seconds

Yards	91.44	Centimeters
Yards	3	Feet
Yards	36	Inches
Yards	91.44×10^{-2}	Meters
Yards	56.82×10^{-5}	Miles
Years (common)	365	Days
Years (common)	87.60×10^{2}	Hours
Years (leap)	366	Days
Years (leap)	87.84×10^{2}	Hours