Alloys of Metals.

Much has yet to be learned regarding the alloys of metals, because a very small difference in the proportions of the metals employed produces a great difference in the quality of the alloy sought to be obtained. A very interesting paper on this subject (as published in the London *Engineer*) has recently been communicated to the Manchester (England) Philosophical Society, by F. Grace Calvert, F.C.S., and R. Johnson. The object of the authors of this paper was to present something reliable and useful regarding the *hardness* of alloys. The process at present adopted for determining the comparative hardness of bodies consists in rubbing one against another, and the one which scratches is held to be the hardest. Thus, for example, when diamond is rubbed against glass, it is found that the former scratches the latter, hence the diamond is justly held to be the hardest. Every person is familiar with regard to the comparative hardness of these two bodies, but very few are acquainted with the comparative hardness of other bodies, especially metals and their alloys, although a scale of hardness has long been adopted among mineralogists.

Messrs. Calvert and Johnson made a series of experiments with pretty large masses of metal to test their comparative hardness; and the following is a most useful table which has been prepared, embracing the results of their investigations :—

Names of Metals.	*Hardness.*
Cast Iron,	1·000,
Steel,	——,
Wrought Iron,	·948,
Platinum,	·375,
Pure Copper,	·301,
Aluminum,	·271,
Silver,	208,
Zinc,	·183,
Gold,	·167,
Cadmium,	·108,
Bismuth,	·52,
Tin,	·27,
Lead,	·10.

This table exhibits the remarkable fact that cast iron is harder than all the other metals; it was found to be harder than any alloy. Its great resistance to a crushing force—on account of its cohesion and hardness—is well known; hence its superiority for the pillars and walls of buildings, and the journal boxes of heavy stationary shafting—the latter, however, should always be lined with a soft anti-friction alloy.

It was found that some brasses were harder than any of the metals composing them, and strange to relate, this hardness is due to the softer metal—the zinc. Thus an alloy of zinc 50, copper 49, was in hardness as compared with cast iron ·604; while an alloy of copper 66, zinc 33, was only ·472 in hardness. The fact was also eliminated that when the quantity of zinc much exceeded 50 per cent of the copper, the brass produced was very brittle. A beautiful brass composed of zinc 50·68, copper 49·32, was made. It contains about 20 per cent more zinc than the brasses of commerce, and yet when carefully prepared it is richer in color, which renders it superior, for many purposes, to commercial brass, also on account of the softness of the latter. We hope American pin manufacturers will take this as a useful hint, because the pins which they now make, although much cheaper than the old "London pins," are far inferior in the quality of metal; they do not seem to have any strength—they bend like a piece of lead wire.

The common alloys employed for making journal boxes are much dearer than a brass composed of zinc 50, and copper 50, and yet they are no harder. For heavy bearing boxes an alloy of copper 82·05, tin 12·82, zinc 5·13, is common. Its hardness is ·562 as compared with cast iron at 1,000, and is lower than the brass of ·604 hardness, yet its cost is at least three times greater.

In a series of bronze alloys containing tin and copper, it was found that an excess of tin was the cause of softness, while an excess of copper, although it is such a malleable metal, is the cause of brittleness. Thus an alloy of 21·21 copper, and 78·79 tin, is not brittle; but an alloy of 34·98 copper, and 65·02 tin is very brittle. When the copper is increased to make an alloy of 84·68 copper, and 15·32 tin, the brittleness is removed, and the alloy is very hard; it is as compared with cast iron at 1,000, ·916 in hardness. A composition of 9·73 copper, and 90·27 tin, is very soft, being only ·83 as compared with cast iron.

An excess of zinc in brass increases its hardness, while the very opposite result would be expected, because zinc is softer than copper. In alloys of copper and tin—common bronze—an excess of tin renders the alloy soft, as would be expected, because it is the softer metal. On the other hand, an increased quantity of copper—from but one-third to that of the quantity of tin in the bronze, up until it (the copper) is four times the quantity of tin—renders the alloy brittle, a result which would not be expected, judging from the nature of the metals in their simple conditions.

Regarding the quality of alloys of all kinds, much, undoubtedly, depends on the mode of mixing them; such as the length of time they are kept at a smelting heat, and the length of time in cooling them. Copper is rendered hard by slow cooling, and soft by rapid cooling, while iron possesses the very opposite qualities.

Alloys containing copper generally contract and become of greater specific gravity. An amalgam of mercury and tin expands, as do nearly all amalgams. The following binary alloys also expand, namely: bismuth and zinc; bismuth and antimony; lead and tin, and lead and antimony. Therefore these alloys should take the sharp outline of molds, and be eminently adapted for casting small ornaments.

Steam Fire Engines for Washington.

On the 25th ult. a bill was passed in the House of Representatives for organizing a paid fire department for the city of Washington, and appropriating $37,000 for the purchase of steam fire engines, and a fire and police telegraph. Here is a chance for the builders of steam fire engines. But like most all government jobs, we suppose the contract for these machines will be obtained upon the strength of political influence, not mechanical merit.

The Amount of Food Consumed by a man During his Lifetime.

M. Alexis Soyer, the celebrated professor of the gastronomic art, entered into a calculation, which he published in the London *Times*, as to the amount of flesh, fowl and fish eaten by a man in an average lifetime, and among the items we find the following enormous quantities :—

30 oxen, 200 sheep, 100 calves, 200 lambs, 50 pigs; in poultry, 1,200 fowls, 300 turkeys, 150 geese, 400 ducklings, 263 pigeons; 1,400 partridges, pheasants and grouse, 600 woodcock and snipe, 600 wild pigeons and teal; 450 plovers, ruffs, and reeves; 800 quails, ortolan and dotterills, and a few guillemots and other foreign birds; also 500 hares and rabbits, 40 deer, 120 guinea fowl, 10 peacocks, and 360 wild fowl. In the way of fish, 120 turbot, 140 salmon, 120 cod, 260 trout, 400 mackerel, 300 whitings, 800 soles and slips, 400 flounders, 400 red mullet, 200 eels, 150 haddock, 400 herrings, and 5,000 smelts; and some hundred thousands of those delicious silvery whitebait, besides a few hundred species of fresh water fishes. In shellfish, 20 turtle, 30,000 oysters, 1,500 lobsters or crabs, 300,000 prawns, shrimps, sardines, and anchovies.

Humming Birds' Tongues.

The tongue of a humming bird is very curious. It has two tubes alongside of each other, like the two tubes of a double-barreled gun. At the tip of the tongue the tubes are a little separated, and their ends are shaped like spoons. The honey is spooned up, as we may say, and then it is drawn into the mouth through the long tubes of the tongue. But the bird uses its tongue another way. It catches insects with it, for it lives on these as well as on honey. It catches them in this way: the two spoons grasp the insect like a pair of tongs, and the tongue bending, puts it into the bird's mouth. The tongue, then, of the humming bird is not merely one instrument, but it contains several instruments together—two pumps, two spoons, and a pair of tongs.

Recent Patented Improvements.

The following inventions have been patented this week, as will be found by referring to our List of Claims :—

Saw Grinding Apparatus—The object of this invention (which has been patented in England as well as in the United States) is to grind circular saws to a uniform thickness and with their faces perfectly even or free from the wavy appearance so frequently produced by some of the methods of grinding heretofore practiced, and to finish them perfectly to the center or eye. The invention consists in grinding the one side of a saw at a time, while the opposite side is supported by a roll which has a rotary motion at the requisite speed to cause the revolution of the saw as desired. A rotating friction clamp is applied to the saw during the grinding process in such a manner that it derives rotary motion from the saw through the agency of friction, and by the momentum acquired by such rotary motion, is caused to control and render uniform the velocity of rotation of the saw, notwithstanding any difference in the thickness of the saw plate, and consequent tendency to variation in the action of the feed roll, or other feeding contrivance upon the thicker and thinner portions of the plate. The saw is arranged to rotate in and during the grinding process upon a flat pivot, which is of sufficient width in one direction to fill the eye of the saw and steady the same as it rotates, and this is thin enough in a transverse direction to permit the grindstone to operate over the whole surface of the saw. W. Clemson, of East Woburn, Mass., is the inventor.

Boiler Feed Regulator.—The kind of regulator to which this invention relates, consists of a cock in the feed pipe at or near its junction with the boiler, and an attached float resting on the surface of the water in the boiler, and operating to open and close the passage through the cock as the level of the water in the boiler varies, for the purpose of admitting or shutting off the supply of water. The cock and float constitute the whole apparatus for feeding a boiler for heating purposes, of so low a pressure that the pressure of water in the supply pipes of cities or the head in an elevated reservoir is sufficient to force in the water, but when the water has to be pumped into the boiler, the inventor generally attaches a lever to the cock to start the feed pump when more water is required in the boiler. The improvement of this inventor—Leonard Thorn, of New York—consists in the peculiar manner of combining the float with the cock, whereby the regulator is made of simple construction and very efficient.

Substitute for Leather.—Samuel Whitmarsh, of Northampton, Mass., has invented a new fabric which is intended to supply the place of leather in many of its applications. The fabric is composed of cotton or other fibrous substances either woven into cloth or in an unwoven state, and saturated or coated with a compound of linseed oil and burnt umber prepared by boiling in every gallon of oil about three pounds of umber in a powdered state, for such a length of time, that the composition when cool will roll in the hands without sticking. The fabric may be made in forms suitable for the soles of boots and shoes, coverings for trunks, traveling bags, cap fronts, or as a substitute for carriage or harness leather, or for machine belting or hose pipe. The mode of producing the fabric differs to some extent according to the use for which it is designed, but the general principles are in all cases the same. The umber is stirred into the boiled oil until it reaches the point desired, when it is ready to be applied in the manner best calculated to produce special articles. This patent is owned by the New York and Northampton Belting and Hose Company, who have secured patents in Europe.

Smoke Consuming Apparatus.—This invention consists in the construction and arrangement of an apparatus for separating the combustible from the incombustible gases which are the products of the partial combustion in a furnace, in such a form as to make the apparatus applicable to all steam boilers or other furnaces and stoves. A chamber is constructed behind or in any convenient situation close to the furnace, and through this chamber the mixed gases pass; the heavier ones such as carbonic acid, being incombustible, pass by a bottom flue to the chimney, while the lighter ones, such as carbonic oxyd, are said to pass by an upper flue back into the furnace, thereto be consumed. W. Davidson Jones, of Hagamans Mills, N. Y., is the inventor.

Composition for Japanned Leather.—The compounds commonly employed for the first, or first and second coats, in the manufacture of glazed or japanned leather or cloth, is made by boiling a certain quantity of umber in linseed oil, and adding a quantity of lampblack or other coloring matter with a quantity of camphene or spirits of turpentine about equal to one and a half times that of the linseed oil. O. S. Boyden and M. Fredericks, of Newark, N. J., have invented an improvement on the above composition, which consists in the substitution either wholly or in part for the camphene or spirits of turpentine in the compound, of a paste made by boiling flaxseed, either whole or after the oil has been expressed, and either ground into meal or unground, in water till its glutinous property is extracted. The use of this paste as a substitute for camphene and spirits of turpentine not only reduces the cost of the compound, but also renders the goods more pliable and less likely to crack.

Improved Furnace Grate.—A. J. Allen & W. S. Hudson, of Paterson, N. J., have invented an improvement in the bars of furnace grates which enables them to have a limited upward and downward movement, and by that means break up all "clinkers" or other foreign substances which interfere with the draft, and also affords facility for their passing through into the ash pit. The fuel is also distributed evenly over the bars, and thus the fire is kept more equal and likely to burn its smoke. The invention is applicable to furnaces using any kind of fuel, but is more particularly intended for the use of anthracite or bituminous coal, and may be used with especial advantage in coal-burning locomotives.

Apparatus for Distilling Turpentine.—The chief feature of novelty in this apparatus is an important one; it consists in having a chamber above the still, in which the barrels of crude turpentine are placed, having first been unheaded, and steam being admitted into the chamber, all turpentine is melted from the barrels and runs into the still. This effects a saving, as in all other apparatus the crude turpentine is scraped from the barrel, and consequently some must be wasted. The still is heated by steam, so that the fire in no place comes in contact with the inflammable material, and the danger of explosion is avoided. Daniel Reid, of Washington, N. C., is the inventor.

Hygrometer.—This invention relates to that description of hygrometer composed of a twisted cord of catgut or other substance which is caused to untwist and twist itself up by the increase or diminution of its bulk produced by changes in the hygrometric condition of the atmosphere. The improvement of this inventor—Chas. L. Clarke, of Rochester, N. Y.—consists in certain means of combining the cord with an index so that an hygrometer of this kind will serve as a weather glass.

Thermometer.—S. Holton, Jr., of Middlebury, Vt., has invented a useful improvement in metallic thermometers so that the pointer is made to indicate correctly upon a dial the variations in temperature.