creases. We see then appear a blue surface, equidistant from the former, and between the two a dark space. The new surface is more brilliant than the other, and shows the bands of the chloride; the dark interval may exceed 1 m.m., and diminishes simultaneously with the increase of the gas. With the acetate of copper the surface of the cone becomes rose-colored, the flame being somewhat reddish. Beneath it is a slender green layer, which appears due to the cupric oxide volatilized in the mixture very hot, but not combined. As for the rose-colored surface, it has the color which the oxide of copper takes in a reducing flame. With a great number of other salts, as those of lime, strontia, etc., the surface of the cone, if the gas is in excess, loses its peculiar color and takes that of the flame, upon which it forms a light pattern. It is the same with salts such as chloride of cobalt, which gives a white flame full of very small solid particles. The author has given a great lustre to the spectrum of the inner cone by placing twenty small flames in a straight line in the axis of the collimator of the spectro-scope. In this manner he has examined the spectrum of platinum chloride. This salt gives at the base of the flame a spectrum of bands not seen when operating in the common manner, and which the spark does not show. This spectrum is formed of sixteen bands, grouped two and two like those of copper chloride, but larger and more remote from each other. Their right margin (on the violet side) is very distinct, and they fade away on the right. Some of them are furrowed with equidistant black rays. We see, also, some fainter nebulous rays in groups of two or three. This spectrum extends from the red to the violet. Some bands, not the strongest, are still visible above the inner cone. This spectrum is due to platinous chloride, which, according to MM. Troost and Hautefeuille, is re-formed at an elevated temperature. All these observations agree in indicating the existence, at the base of the flame, of a very thin stratum where the temperature is much higher than in the flame itself—a result which theory renders probable.—*Comptes Rendus*.

NEW ORGANIC ACID OCCURRING IN NATURE. C. STAHLSCHEIDT.

THE acid in question, the polyphoric, occurs in certain fungi of the family *Polyporus*, growing on the stems of diseased or dead oaks. The empirical formula is $C_6H_4O_8$. This acid has a yellow color, and is so completely insoluble in water that the slightest trace of a soluble polyphorate in water renders the liquid turbid on the addition of salt or of soluble sulphuric acid. In virtue of this property the soluble polyphorates may serve as indicators in alkalimetry, the turbidity serving instead of the usual change of color. With all bases it forms well-defined salts, of which the soluble ones, those of the alkalis and ammonia, form deep purple solutions. On heating polyphorate of potassium to redness in a combustion-tube along with zinc-powder, benzol was obtained, which was identified by its conversion into nitrobenzol and thence into aniline.

RESEARCHES ON THE GASES CONTAINED IN THE TISSUES OF FRUITS. M. A. LIVACHE.

IN sound fruits contained in the tissues are formed of a mixture of oxygen and nitrogen in the same proportions as in the atmosphere. If the tissues are lacerated the oxygen is rapidly transformed into carbonic acid. If such fruits are left for some time a true fermentation sets in, and there is a plentiful evolution of carbonic acid, whilst the nitrogen undergoes no change.

THE juice of the sugar cane, according to Arno Behr, contains aconitic acid, which was obtained from the preserved juice and from crude sugar, from the latter to the amount of 0.149 per cent. Some Cuban sugars separated from their aqueous solutions minute crystals of aconitate of calcium. Pure aconitic acid, obtained from this source and from citric acid, was found to fuse at 187 to 188° C.; the lower fusing point usually given is due to impurities.

The author found also oxalic acid in the precipitate, obtained by dissolving crude sugar in little water, and mixing the solution with alcohol. *Ber. d. Chem. Ges.*, 1877.

CARBONIC ACID IN "GROUND AIR."—Dr. Port.—Determinations of carbonic acid in the ground air were made at Munich at depths of 1.5 to 3.0 metres. It appears that the greatest amount of carbonic acid was generally observed in the autumn. In most of the stations the proportion of carbonic acid was greater in 1873 than in 1874. In some stations there was more carbonic acid found at the depth of 1.5 than at that of 3 metres, but in most instances the proportion was reversed. The proportion of carbonic acid in the ground air gives a useful measure of the degree of pollution of the soil.

EXTRACTION OF COPPER BY AN ACID SOLUTION OF FERROUS CHLORIDE. M. A. HAUCH.

To diminish the quantity of hydrochloric acid consumed in the extraction of copper from malachite, the author uses the acid solution of ferrous chloride obtained in precipitating copper from its hydrochloric solution by means of iron, as resulting from former operations.—*Oesterreich Zeitschrift für Berg. und Huttenwesen*.

PROPORTION OF CARBONIC ACID IN THE ATMOSPHERE.—Prof. Franz Farsky.—As the mean of 295 determinations the author gives the proportion of carbonic acid as 3.43 vols. in 10,000 of air. This figure is lower than those found by De Saussure and J. Boussingault, but higher than the results obtained by Schultze, Henneberg, Fittbogen, and Hässelbarth. The most numerous fluctuations were observed in November, December, February, March, and April, and the fewest in October. All meteorological conditions were registered along with each observation.—*Biedermann's Central-Blatt*.

SOLUBLE GLASS FROM INFUSORIAL EARTH.—F. Capitaine.—The author recommends infusorial earth, very plentiful in North Germany, as suitable for yielding silicate of soda, by treatment with a caustic lye at sp. gr. 1.2, under a pressure of three atmospheres. The soluble glass thus obtained is much richer in silica than that made from flints.

NEW METHOD OF TRANSFORMING CAMPHOR INTO CAMPHEN.—M. J. de Montgolfier.—The camphor after fusion is treated with sodium at a gentle heat.

CALIFORNIAN STAMPS.

THE Cornish stamps are those described and shown in the pages of *Agricola* nearly 300 years ago, excepting perhaps the stems, which in some instances are now of bar-iron, square in section. The practice of Californian mill men is to erect heavy stamp heads, working at a high speed, with a short drop. It is alleged that such heads will reduce more stuff than an equivalent amount of power expended in running high stamp heads, at a low speed and high drop. Six heads in a mortar or kover are preferred to three, the number usually included in a Cornish kover. The weight of a heavy head may be taken at 700 lbs.; medium drop of head, 10 in.; number of drops per minute for high speed, 90.

MORTARS.

Mortars are constructed so as to be adapted to the peculiar conditions of their use. The mortar for dry crushing is suitable for either gold or silver ore, while with wet crushing the gold mortar differs from that used for silver. When machinery is to be transported to locations which are inaccessible to wagons the mortars are made in sections, and fastened together permanently when they are put in their place.

MORTAR.

SECTIONAL MORTAR.

DRY MORTARS.

The dry mortar is illustrated in the accompanying cut, together with the "sectional mortar." In this pattern of mortar the die is set high, as in the wet mortar for gold. The screens are more inclined from the perpendicular than those of wet mortars, and there is a double discharge. The width of the bottom upon which the die is set is about 11 in. for a die 8 in. diameter, while the outside length is about 52 in.

SECTIONAL MORTARS.

In the sectional mortar the upper part is made of boiler plate, fastened at the corners by angle iron. The bed is of cast iron, in sections, cut transversely. A bar of wrought iron is fitted into a groove planed in the bottom, with rivets holding it securely to the sections. This prevents any work-

WET CRUSHING MORTARS.

COLD MORTAR.

SILVER MORTAR.

ing of the sections sideways. The sections are firmly bolted together by strong bolts, turned to size, and driven after a reamer. This mortar when set up is very stiff and enduring.

WET CRUSHING MORTARS, GOLD AND SILVER.

The mortar for gold, used with wet crushing, is adapted to be lined with copper plate. The screen doors are also lined with copper, and the discharge is above the lining.

The general shape of the silver mortar for wet crushing is almost identically the same as the gold mortar. The die, however, sets lower, while the screens for which openings are made on each side are brought nearer to the middle line of the stamp, and have their whole surface available for discharge.

CAMS.

Cams are made as shown in the accompanying cut, either with one or two arms. The single-armed cam will permit greater speed of stamps than the double-armed cam.

It will work up as high as 110 drops per minute. The majority of mills use double-armed cams, in order to avoid friction of the cap shaft, since they give two drops of the stem to every revolution of the shaft. The proper curve of

the cam is a modified involute of a circle, the radius of which is equal to the horizontal distance between the center of the cam shaft and the center of the stamp stem. The modification of this curve consists in giving a sharper curvature than the involute near the end. This form of cam takes the weight of the stamp at the least practicable distance from the center of the cam shaft, where the lifting motion is slow and the concussion comparatively slight, and leaves it in such a way, on account of the quickened curve, so that the point of the cam shall not tear along the face of the tappet from a line through its center to the outer edge or point of delivery. The outer end is shaped to conform to the edge of the tappet. It is proper to remark here, since the curve of the cam is determined by the distance between the centers of the cam shaft and the stem, that in the erection of the machinery this distance should be strictly adhered to, in order to insure the satisfactory working of the cam.

TAPPET.

SOCKET.

SHOE.

DIE.

TAPPETS.

The tappet, or lifter as it is sometimes called, is secured upon the upper part of the stem, and forms a projection $2\frac{1}{2}$ in. wide, under which the cam catches and lifts the stamp. In the annexed cut, A is a vertical section of the tappet. It is made of cast iron, and weighs from 60 to 70 lbs. It is alike at both ends, so that when one face becomes worn it can be reversed upon the stem. Formerly the tappets were attached to the stems by means of screw threads cut upon the latter, the tappet being screwed down as a nut upon a bolt; afterward key seats were cut, to receive the transverse key, but these methods have been superseded by a much more simple and convenient device of a wrought-iron gib, set up against the stem by keys, which has received the name of "gib tappet." The tappet is cast with a rectangular recess in one side of the hole for the stem. Into this recess a "gib" is placed. This is a rectangular block of wrought iron, flat on one side, but hollowed on the other, so as to fit the curvature of the stem. Two transverse slots, or openings, at the back of the recess, are provided for keys or wedges, by which the "gib" is wedged tightly against the stem, so that the tappet is firmly secured at any desired angle. Thus no key seat or change of the form of the stem is required, and the tappet can at any time be removed without difficulty, merely by driving out the keys.

SOCKETS.

The stamp head or socket is cylindrical, and made of the toughest cast iron, sometimes strengthened with wrought-iron bands at the top and bottom, shrunk on while hot. It is cast with two central openings or sockets, one in each end, the upper one being for the reception of the tapered end of the stem, and the lower and larger opening for the shank of the shoe. Transverse rectangular openings, or keyways, are made through the socket at the bottom of each end opening. These are for the purpose of driving out the shoe or of detaching the socket from the stem by inserting steel keys or wedges, which bear against the end of the stem or of the shoe, and when driven in separate the one from the other. With proper care the socket wears for years, and after being once attached to the stem need not be removed, but the shoe wears out in a few weeks.

SHOES AND DIES.

The form of the shoe is shown by C and the die by D. Both are cylindrical, and are cast of the hardest and toughest white iron. The shoes are usually 8 in. in diameter and 6 in. in height from the face to the shank. The dies correspond in diameter at the face, but they are often made with a broader face than the shoe. Their base is either a rectangular flange with the corners taken off, or it is round throughout its whole length, and seated into a socket in the bottom of the mortar. The different parts of the stamp are generally disconnected when shipped, since their construction permits of their being united with ease when they are to be placed in the battery. In order to fasten on the tappet it is only necessary to slip it on the stem, and then wedge it fast by means of the gib and keys. To attach the stamp head to the stem the socket is placed upon the die in the mortar, and the stem is dropped into it. A few blows of a hammer upon the upper end of the stem will wedge it firmly into the socket, and it is made lighter by allowing it to drop, socket and all, upon the die. This is regarded as a permanent connection, but with the shoe the case is different, and to render it less difficult to remove this part when worn out, the shank before being inserted into the socket is covered with strips of pine about $\frac{1}{4}$ in. thick. These are held in place by a string while the shoe is placed in its proper position upon the die, and the stamp head is allowed to fall upon it. It thus becomes tightly wedged in the socket, and may be raised with it. After dropping a few times upon the die (protected by a bit of plank) it is driven "home," but there must be a little space left between the top of the shoe and the lower surface of the socket. A stamp thus put together with a 3-in. stem and a 200-lbs. socket will weigh about 620 lbs., the tappet weighing 70 lbs. and the shoe 95 lbs.

CAM SHAFT.

The cam shaft is usually made $4\frac{1}{2}$ in. in diameter for five stamps, and sometimes 5 in. diameter for running ten stamps, with a bearing at each battery post. The pulley on its end is made of wood, built on flanges. The cams are keyed on by either one or two keys each.

GUIDES.

The guides in which the stamp stem is run are generally made of the finest wood that can well be obtained, and they are secured to the girts of the battery frame by means of collar bolts between each two stems. They are constructed in halves, so that when worn by the stem they may be closed up to it by dressing down their faces.

THE SCREEN.

The screen for working ores by the wet process is made generally of Russian sheet iron. This iron has a planished, glossy, and smooth surface; it should be free from rust or flaws, and be very soft and tough. The severest test of sheet iron consists in hammering a part of the sheet into a concave