cm. high and 180 cm. broad. The space between the wooden jacket and the iron still is filled with ashes to the exclusion of the air. A temperature of 48° C. is required for the distillation, and is produced by the introduction of steam between a double base or bottom.

The vapor of the carbon bisulphide passes off through a tube and is condensed in a row of four cooling tubes, which are surrounded by water. The carbon bisulphide is collected beneath water. The filling and clearing of the vessel may be accomplished by means of a small aperture at the top of the vessel. In charging, 40 to 50 hectoliters of raw carbon bisulphide are placed in the vessel, and steam used at about 0.3 to 0.5 atmospheric tension. About two hours after, the distillation commences, which is very strongly evidenced by the heat of the exit tube, while a hissing is heard in the condenser, sulphureted hydrogen being also liberated at the earliest stage of the operation. The refining process lasts about six hours. The residual sulphur in the vessel must be cleared out with a wooden scoop. It is in this operation that the workman is exposed to the escaping vapors of carbon bisulphide, and is thereby very seriously affected. The destructive reaction of carbon bisulphide upon the organism is indeed so considerable that, as Cloez states, as small a volume as 5 per cent. of the vapor in the air is sufficient to kill the smaller mammalia, as well as birds and reptiles. The workman suffers from headache, vomiting, and has irresistible fits of weeping, soon feeling violent pains in his limbs, chiefly in the legs, and finally all his bodily and mental powers are paralyzed or much impaired, and loss of memory is noticed to ensue. It has happened even that the workman lapses into idioecy.

It has been tried to expel the CS₂ and other substances present out of the residual sulphur by raising its temperature considerably. But as the vessel can only stand a pressure of half an atmosphere, the difficulty is overcome in another manner. The vessel is filled three parts with water and steam let directly into the liquid. The water is brought up to boiling, and the carbon bisulphide is thus distilled over. The heating occupies about 20 hours, whereupon the water can be drawn off and the sulphur removed without any danger. This residual sulphur is used up again in the raw production of the carbon bisulphide.

The refined carbon bisulphide is removed 15 hk. at a time and stored up under water in sheet-iron cylinders holding about 30 to 80 hk. The supply is executed in 500 or 100 kilogramme lots, in wrought iron and airtight cylinders. For the first quantities a space of about 12 liters, for the latter 25 liters, to allow for the expansion of the carbon bisulphide.

The total production of the refined carbon bisulphide is taken over by the Hungarian Agricultural Secretary of State for 18 florins per hectoliter and distributed among the schools for vine culture and other economical associations as a destructive agent against phylloxera.

The cost of production is from two to three florins (four to six shillings) per hectoliter. Up to 1889 only one of the two retorts available was used at a time, but since the enlargement of the works the process is generally carried on in three retorts out of four simultaneously.

The annual production of raw CS₂, with one oven, is 1,102 hectoliters. The total production per annum can therefore be estimated at $4 \times 1,102 = 4,408$ raw or — taking the pure at 80 per cent. — at 3,500 hectoliters, which corresponds approximately to the present consumption in Hungary.

The production of the raw CS₂ is a very complicated and dangerous process, so much so that at first the utmost difficulty was experienced to obtain any workmen to perform the operation. Besides the use explained in this article, it is also used for the extraction of oils from seeds, etc., solution of resinous substances, alkaloids, phosphorus, and sulphur.—Zeit. f. angew. Chem.

A NEW FORM OF AIR BATH.

By E. SAUER. J. Amer. Chem. Soc.

IN order to insure a constant temperature, which shall not be limited by the boiling point of some liquid

contained in an outer jacket, the author has devised the form of air bath shown in the figure. The bath has a false bottom, perforated to allow a series of tubes to connect the inside of the oven with the outside air beneath the apparatus through the real bottom; the latter, in addition to corresponding perforations, has a larger central aperture through which the flame of a Bunsen burner can play upon the false bottom and around the connecting tubes; the products of combustion pass away through the sides of the lower chamber between the two perforated plates, the sides being left open. Evaporation is facilitated by the rapid re-

newal of the atmosphere within the bath by means of the tubes; and experiments are quoted to show that not only is evaporation rapid, but the temperature at different points of the bath is very uniform.

DROPPING FLASK FOR STANDARD SOLUTIONS.

By F. VANDERPOEL. J. Amer. Chem. Soc.

THE use of burettes for standard solutions involves serious errors (e. g., such as arise from alterations of temperature), which can be avoided by substituting

weighing for measuring. The figure shows a simple form of dropping flask for standard solutions, which has been found convenient. The figure is almost self-explanatory. It suffices to say that the central rod is of glass, and passes through a cork in the upper tubulus of the flask, and is ground into the lower exit tube, thus serving to regulate the outflow. The side tubulus is used for filling the flask. The whole apparatus can be slung to a hook on the balance, or supported on a light tripod in the manner of a weighing bottle.

IMPROVEMENTS IN THE PRODUCTION OF CHLORINE AND REFINED LEAD AND RECOVERY OF SILVER.

By F. M. LYTE, London.

LEAD chloride is formed from yellow lead oxide (preferably) or from lead oxychloride, by grinding

with an excess of aqueous hydrochloric acid, in a pan having a granite bottom and stoneware sides; or enameled metal pans may be used, an example of which is shown, in which stone mullers are carried round by cross arms and stay rods of a frame revolving on a center, and resting at their outer ends on rollers on a circular rail supported by adjusting screws to regulate the grinding action. Silver chloride may be dissolved out of the product by strong hydrochloric acid or solution of a suitable alkaline-earthly chloride; and on filtering the warmed solution through spongy lead, silver is deposited. Or the argentiferous lead chloride may be fused over lead, the chlorides being used in successive charges until the lead is sufficiently enriched for recovery of the silver by cupellation.

Crude lead may be oxidized in a basic-lined Bessemer converter, in which a high temperature is attained, and the silver becomes concentrated in the small proportion of lead that escapes oxidation. The last traces of silver may then be recovered from the litharge and fume in the manner first described.

Lead chloride may be purified by solution in hot water and crystallization, the same water or mother liquor being repeatedly used. The chloride is then washed, dried, fused and electrolytically decomposed in the fused state, to obtain lead and chlorine, in the apparatus represented above.

The iron pan, A, set over the furnace, M, contains lead, L, into which the earthenware or plumbago bell, B, dips, the lead being melted to receive it, and then allowed to set, while the bell is charged with lead chloride by removing the cover, B', and afterward with successive additions through the inlet, F. EE are carbon anodes, each hollowed to receive a fusible metal core, preferably of lead, connected to the conducting wires. H is the cathode terminal dipping into the lead, L. As the molten lead increases by decomposition of the chloride, it runs off by the pipe, D. The apparatus shown is intended for connection in series, the chlorine entering from another cell by the pipe, G, and having outlet by the pipe, G'. It is a feature of the invention that the air in the cell should be displaced by a non-oxidizing gas, as chlorine or nitrogen, in order to avoid any formation of lead oxide in the process.

FLAMES IN FOUL AIR.

AT the last meeting of the Federated Institution of Mining Engineers, Dr. Frank Clowes read a paper on "The Proportion of Carbon Dioxide (Choke Damp) in Air which is Extinctive to Flame." It contained a suggestion of a method for ascertaining the limit of safety of mixtures of carbon dioxide and air. It appears from Dr. Clowes' own experiments, in which the effect of atmospheres containing known proportions of carbon dioxide was determined from a variety of naked flames, that candles and ordinary lamp flames, inclusive of colza and petroleum and ordinary lamp paraffin, cannot live in an atmosphere containing from 14 to 16 per cent. of added carbon dioxide. On the other hand, the flame of burning hydrogen is not extinguished until 58 per cent. of carbon dioxide has been added to the air; and coal gas will burn with 33 per cent. of added carbonic acid. Methane will only stand 10 per cent., while carbonic oxide will endure 24 per cent. of the same addition. The author exhibited a lamp in which a flame of hydrogen was burning at the side of an oil flame, and he showed the superior endurance of the former when exposed to vitiated air. He concluded by remarking that the wisdom of attempting to pass through foul air in mines, wells, etc., has been questioned, because it has been assumed that an atmosphere which contains sufficient carbon dioxide to extinguish the oil flame of a safety lamp would necessarily be irrespirable, or at least dangerous to life. Experiments recently conducted by Mr. T. H. Wilson, however, have gone to prove that rabbits can breathe with impunity for an hour at least air containing 25 per cent. of carbon dioxide. The presence of 16 per cent. of this impurity extinguishes the ordinary safety lamp flame. Hence it appears that respiration can be maintained unimpaired in air containing at least 10 per cent. more choke damp than is sufficient to extinguish the oil or alcohol flame of a safety lamp. If Mr. Wilson's experiments are accepted, it would evidently be well to have some test less sensitive than the ordinary safety lamp flame to indicate whether an atmosphere contains sufficient carbon dioxide to be dangerous to life. Since the flame of ethylene is only extinguished with 26 per cent. of added carbon dioxide, such a flame might serve the purpose. It is worthy of notice, in this connection, that a naked coal gas flame will seemingly continue to burn in air that has long passed the limits of added carbon dioxide compatible with the preservation of human life.

THE ALKALOIDS OF COD LIVER OIL.

AMONG the exhibits in the museum at the recent meeting of the British Medical Association, Bristol, a particularly interesting specimen was a substance exhibited by Messrs. F. Stearns & Co., of Detroit, under the name of "Panjecorine." As the name signifies, this was a specimen of the total alkaloids contained in a sample of cod liver oil. This subject was first taken up by MM. Gautier and Mourgues, who published in 1890 (Journ. de Pharm., March, 1890) a detailed account of their experiments and the substances extracted by them from the oil. These were butyl, amyl, and hexyl amines, dihydrotoluidine, aselline, morrhine and morrhucic acid (the gaduine of De Jongh); the latter two being the most important bodies. In reply to charges that these bodies were probably decomposition products, an article appeared in the Comptes Rendus (November, 1892), from the pen of M. Bouillot, showing that by the aid of gaseous hydrochloric acid and platinum perchloride the alkaloidal bodies could be crystallized in situ in the fresh liver, and their form identified with that of the bodies extracted from the oil. Microscopical drawings of the principal active bodies are shown below. The subject is being followed up by Professor Schlotterbeck, of the University of Michigan, who has confirmed the results of MM. Gautier and Mourgues, and who prepared the specimen exhibited at Bristol. Up to the present a ready method of separating the various constituents from each other has not been found, but there does not appear—at all events as far as the medical activity of the bodies is concerned—to be any necessity for separating

the mixed bases further. The total combined alkaloids or "Panjecorine" have so far proved to be quite equal to the cod liver oil itself, but it has not yet been proved whether or not the residual oil has any medicinal value. Professor Schlotterbeck is preparing a further paper for the forthcoming meeting of the American Pharmaceutical Association. The combined alkaloids are readily soluble in dilute alcohol, and Messrs. Stearns are utilizing this property in preparing a wine of cod liver oil, which clinical reports state to be quite as valuable as the oil itself, while free from its unpleasant taste.