cent. of commercial glucose. Another fruit juice containing the same amount of solids and polarizing —5° after inversion contains approximately 9 per cent. of glucose.

At 22° the formula becomes $x=\frac{0.33\ a+b}{2.08}$, and there is a decrease of one in the second decimal of both numbers for each rise of 2° in the temperature.

LOS ANGELES, CAL.

AN IMPROVED CONDENSATION APPARATUS.

BY H. E. BARNARD AND H. E. BISHOP.

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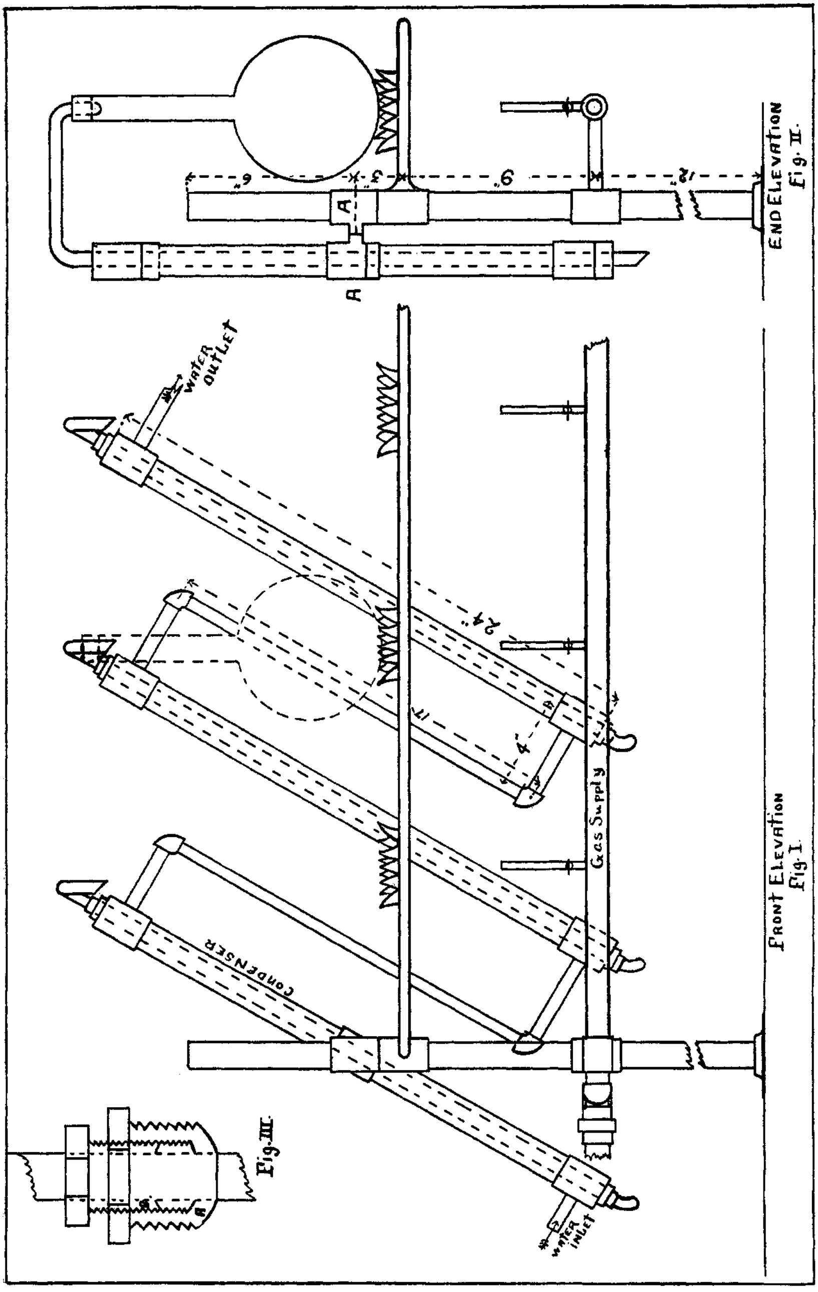
FOR some years the earlier form of distillation apparatus, consisting of a copper tank through which the worm of the still passes, has been undergoing modifications and several very satisfactory types have been described which substitute for the condensation tank suitable piping so fitted that the worms pass through the pipe and are thereby constantly subjected to water under pressure.

We have recently designed and constructed a bank of stills, the arrangement of which is different from anything the writers have seen, and which is illustrated by the accompanying working drawings.

The apparatus consists essentially of three parts. The condensers, the support for the flasks and the battery of burners. For the condensers we use inch pipe for the water jackets, and three-eighths pipe for the connection from one jacket to the next. For the top and bottom of the water jacket, ordinary pipe fittings are used, one inch T's with a $\frac{3}{8}$-inch opening. To form a water-tight joint between the water jacket and the block-tin condensing tube, we use an ordinary packing box which is shown at Fig. III in the drawing. It is a brass cup, which fits into the end of the T, which in turn forms the end of the water jacket. B is the jam nut to press the packing against the block-tin tube shown in broken section. The tops of the cup and jam nut are made hexagonal so that they may be turned with a monkey wrench. By studying the drawing at Fig. II, A, it will be noticed that the water jackets are supported by placing a T in the centre of a water jacket tube. This is accomplished by using two short lengths of inch pipe instead of one long length as in the other water jackets.


End Elevation
Fig. II.
Front Elevation
Fig. I.
Fig. III.
Gas Supply
Condenser
Water outlet
Water inlet
24"
4"

This T is turned at an angle of 90° to the T's at either end of the water jacket; an ordinary $\frac{3}{8}$-inch plug screwed into the T and then a $\frac{3}{4}$-inch by $\frac{3}{8}$-inch cross screwed on to the plug. The threads are reamed out of the cross so that it will slip on the supporting tube easily. The other opening of the cross is filled with a plug with a set screw tapped into it to hold the water jackets in place. The support for the flasks is merely a gas pipe frame covered with galvanized iron. It is attached to $\frac{3}{4}$-inch by $\frac{3}{8}$-inch crosses to hold it in place, as are the water jackets. The openings for the flames are made by slitting the metal in the form of an asterisk (*) and turning up the points in such a manner that they form a springy seat for the round-bottomed flasks. The gas supply pipe is attached to the supporting posts as are the water jackets and the flask support by $\frac{3}{4}$-inch by $\frac{3}{8}$-inch crosses with a plug containing a set screw in one side, and a $\frac{3}{8}$-inch nipple in the other side. The burners are attached to $\frac{1}{8}$-inch air cocks and these are tapped directly into the supply pipe. It will be necessary to rotate this pipe slightly when the burners are raised or lowered. Therefore the support for this pipe is made by reaming out the threads of a $\frac{3}{4}$-inch by $\frac{3}{8}$-inch T and allowing the gas pipe to slip through this T loosely. The connection with the gas supply will hold it in place. The ordinary Bunsen burner will just fit the $\frac{1}{8}$-inch thread on the air cocks so that no fitting is necessary here.

The posts supporting the apparatus are of $\frac{3}{4}$-inch pipe screwed into ordinary floor plates, which in turn are screwed to the table.

The appearance of the apparatus is greatly improved by a coat of aluminum bronze.

This apparatus possesses several advantages that makes it of value to chemists who have much routine work to do where distillations are required, as in water analysis, nitrogen determinations, alcohol estimations, etc. In the first place, a perfect condensation is always secured, as the water in the condensers is under ordinary hydrant pressure. We employ a gang of 10 stills and even when in constant use, the distillate is always perfectly cold. It takes up but little bench room because of the slanting arrangement of the condensers; the entire apparatus can be readily set up on a bench or shelf not over 12 inches deep, placed against the wall, and the distillates are always in easy reach. All parts are adjustable and any size flasks may be used by raising or lowering their support. The slant of the condenser makes it possible by rotating the block-tin condensing tube to raise the distillation flask completely from its support. It may then be easily removed without danger of breaking. The apparatus costs but a third as much as when made with copper condensing tank, and is practically indestructible; the materials employed in its construction can be obtained of any plumber or gas fitter and put together with a pipe wrench. Under ordinary conditions the labor and material for a ten-tube still will not cost more than $35.00.

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SOME EXPERIMENTS ON THE DETERMINATION OF VOLATILE COMBUSTIBLE MATTER IN COALS AND LIGNITES.[1]

BY E. E. SOMERMEIER.

Received May 28, 1906.

THE method in general use in this country for the determination of volatile combustible matter is that recommended by the Committee on Coal Analysis appointed by the American Chemical Society.[2] The directions given are as follows:

"Place 1 gram of fresh, undried, powdered coal in a platinum crucible, weighing 20 or 30 grams and having a tightly fitting cover. Heat over the full flame of a Bunsen burner for seven minutes. The crucible should be supported on a platinum triangle with the bottom 6 to 8 cm. above the top of the burner. The flame should be fully 20 cm. high when burning free, and the determination should be made in a place free from draughts. The upper surface of the cover should burn clear but the under surface should remain covered with carbon. To find 'Volatile Combustible Matter' subtract the per cent. of moisture from the loss found here."

This is the method used in the volatile determinations made in the Chemical Laboratory of the United States Geological Survey Fuel Testing Plant, the only modification being that the flame is protected from air currents by enclosing in a cylindrical

[1] Published by permission of the Director of the United States Geological Survey. Read before the Columbus Section of the American Chemical Society, May 23, 1906.

[2] This Journal, 21, 1122–1126.