Aspirating Device for NBS CO Indicating Tubes

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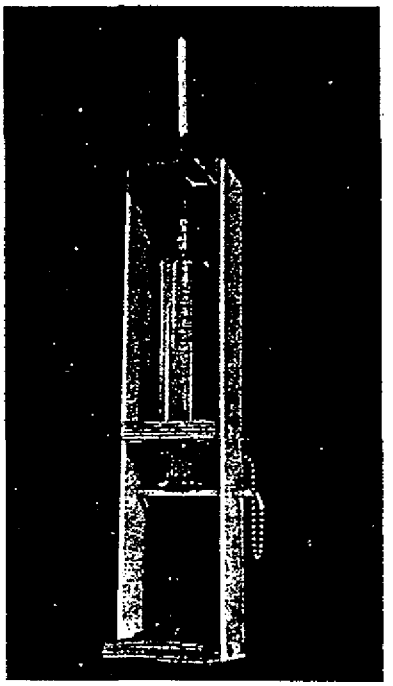
Some time ago we needed to determine a very low concentration of CO in a small sample of air.

Having on hand a quantity of National Bureau of Standards CO indicating tubes but not the needed aspirating device, we constructed the instrument shown in photograph No. 1.

It consists of a 50 ml. syringe, locked in a vertical position, having a B–D No. 24 short needle. The needle penetrates a rubber stopper inserted in a short length of brass tubing press fit into the upper wooden block. The other end of the brass tubing serves as seat for the rubber stopper into which the indicating tube is inserted.

The plunger is weighted to give the desired rate of flow. In the instrument shown, this was accomplished by filling the plunger with buckshot through a hole drilled in the handle. An alternate method is suggested in the drawing. To eliminate variations in flow due to friction between the plunger and the housing, the plunger is made heavy and the flow restricted by use of the relatively fine No. 24 needle. The weight of the plunger shown in the photograph is 275 g.

No. 1



The color development of the NBS tubes is critical to the rate of flow. They have been calibrated for a rate of 90 ml/min. In determining the load of the plunger a fresh tube should be connected to the inlet side of the syringe and the plunger successively weighted until the time taken for the plunger to pass between the 5 ml. mark and the 50 ml. mark is exactly 30 seconds.

The volume equivalent to 1 squeeze of the NBS instrument is 54 ml. A stop consisting of a cork black or other means should be attached to the base to limit the stroke of the plunger to the above volume.

In the field, a tube, after breaking the seal, is inserted in its place at the top of the instrument which is then placed in a position as vertically as possible. Molding the plunger with the finger against its top position the pin stop is removed and the finger released to let the plunger travel by its own weight. After the stroke is completed the tube is removed and read, and the plunger pushed up to its top position. (On later models the side pieces protrude above the brass tubing, as indicated in the drawing. This permits the operator to stand the cradle on its head letting the plunger slide back to the original position while the tube is being read or exchanged.)

The device has been very successfully used. It is easily constructed and easily maintained. The syringe may be quickly removed for cleaning with alcohol when and if necessary.

Its chief advantage over the squeeze-bulb type is the ease with which the rate of flow is checked and the fact that the flow is constant throughout the sampling period.

The availability of a simple method to obtain a constant rate of flow caused us to reexamine our method for determining H_2S by the use of filter papers impregnated with lead acetate as described in Leaflet No. 1, Department of Scientific and Industry Research. Previous calibration of the papers against known concentration of H_2S has shown rather wide variations when aspirating the test gas manually by pumping. After constructing the device shown in photograph No. 2 it was found that excellent reproducibility was obtained at a rate of flow of 300 ml/min. Thus by producing stains from known concentrations and reading the percent light reflection of the stain compared to that of unstained paper (in a meter of our own design), a calibration curve was obtained fully as accurate and reproducible as many of the curves of colorimetric solutions in standard colorimetry. The pump shown in photograph No. 2 was obtained from a Sears Roebuck tire pump and converted to a suction pump. It had a capacity of 600 ml. The lead weight weighs 1,240 g. A No. 20 syringe needle inside the tube connecting the test paper holder with the pump serves as the flow constricting orifice.

No. 2