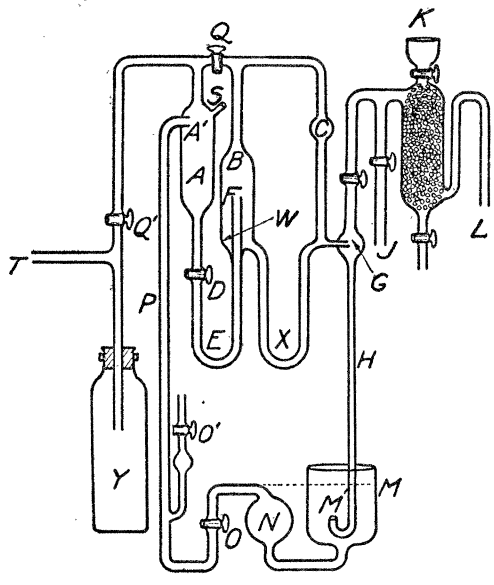
A NEW VACUUM PUMP

IN connection with certain bacterial fermentation studies a new Sprengel pump was designed with three distinct requirements in view: First, to avoid the labor accompanying the raising and lowering of the heavy mercury reservoir of the Sprengel pump; second, to prevent the carrying over of air bubbles from the main mercury reservoir to the falling tube, and third, to make the pump simple, inexpensive and serviceable both for exhaustion and for the collection of gases.

The first difficulty has been overcome successfully by the so-called Boltwood pump, as well as the present device, while the new pump alone meets the other two requirements completely, with the feature of automatic operation retained.

The following description of the new pump and of its operation may be of interest to those who are facing the same problems as the writer's.



A is the main mercury reservoir. Both B and C bulbs are air traps, C being used to insure the complete removal of the air bubbles, should they escape from the trap B. One end of the inverted syphon E is fused into the air trap B, so that the mercury level in A and B bulbs is always maintained, while the flow of the mercury from A to G is regulated by the stopcock D. H is the falling tube, which has a diameter of 2 mm. and a length of 150 mm. A McLeod vacuum gauge J is connected to the head of the falling tube H, which terminates in one arm of the drying chamber K. The fermentation tube L is jointed to the other arm of the K chamber. M is the mercury-reservoir, to collect mercury coming from the falling tube. N is the leveling tube whose height must be above that of the inverted end of the falling tube in order to keep it under mercury; especially important during the time of collection of the gases.

The return of the mercury from M to A is accomplished through the tube P with the aid of air admitted at O' and mainly by the suction force at T, which is connected to a water aspirator. Y is a safety bottle used to receive any "kick-back" water from the aspirator. S opening at A is employed for the filling and emptying of the mercury. It can be sealed up easily by a small rubber stopper. Stopcock O is to regulate the flow of the surplus mercury from N, and stopcock O' to regulate the required amount of air to be admitted to tube P.

The pump is operated as follows: Fill the bulb A with mercury through the opening S up to the level below A'. Then open the stopcock D, allowing the mercury to flow slowly through E over the top of F, filling the depression W, and then through X to G. The stopcock D should be so regulated that the rapidity of the flow of mercury dropping down from G will give the rate needed. When the atmospheric pressure is reduced to about 40 cm., the suction force (aspirator being previously opened) is applied by opening the stopcock Q'. At the same time, the stopcocks O and O' are also regulated, so that the mercury collected in M and H can be retruned to A by the same suction force from T. A continuous supply of mercury in the bulb A is thus maintained; also, a complete circuit of broken mercury will be seen from G to A as long as the aspirator is running.

The air bubbles carried over by the mercury from A will rise as soon as they emerge from F, and will be swept away by the suction force from the aspirator through Q. The same process is repeated at C. Q must be opened very little in order to prevent the suction force from being strong enough to draw the gas from L through G, instead of being carried down by the mercury drops.

So long as the aspirator is kept in operation, two partial vacuum traps at B and C are created and maintained, from which the chances for the air bubbles to escape downward are very slight. If they escape at all, the quantity would be so trivial as to cause no serious consequence.

The same pump and the same process of operation are applicable for exhaustion of the culture tube or bottle and for the collection of the bacterial gases. However, when an inverted Hempel burette is used to receive the gas, the mercury level at M must be kept at about M'. Very little effort is required to manipulate this apparatus when it is once set in operation, provided that the water aspirator has a pressure of 20–25 pounds per square inch, which can always be had in almost every ordinary laboratory.

A minimum atmospheric pressure of about 0.02 mm. has been attained with this apparatus.

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