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ARTHUR D. LITTLE, INC.

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N.D.R.C. DIV. Office of Division 11  
National Defense Research Committee

ONR-269  
Supplement No. 2

Sept. 27, 1943

Progress Report Covering Period from Aug. 15 to  
September 20 on Development of Test Unit for Production  
of Oxygen by a Regenerative Chemical

Work on the Arthur D. Little, Inc. shipboard unit has been completed during the period covered by this report. An inspection by navy personnel was held on September 17 and the unit was accepted for installation on the navy's repair ship, U.S.S. Prairie. Installation will be supervised by two members of the staff of Arthur D. Little, Inc. These men will accompany the unit during its initial period of use by the navy and report to the National Defense Research Committee on the service performance of the unit.

Since our report dated August 19, a few changes and additions have been made to the unit.

Clark Bros. Co., Inc. sent a man to Cambridge to install a new design head on their compressor. The new design eliminates uncertainty as to correct alignment of the valves in the compressor.

Their overhaul of the compressor showed it to be in good condition. A slight leak from the water-cooling system into the piston chambers was noted, which seems to have been the cause for the water in the oxygen storage system. With the new head no water has been found in the oxygen storage tank.

The fresh-water, cooling system for the compressor has been installed. This consists of a copper heat exchanger for cooling the fresh water with sea water; a centrifugal pump for circulating the fresh water, and a reservoir from which to pump. The circulating pump is driven by the 10 H.P. motor used to drive the compressor.

A Fisher, spring-loaded, vacuum regulator has been installed to control the compressor suction pressure. Also the Mason-Kellan, steam-pressure regulator has been replaced by a Fisher Type 57, steam regulator.

All new equipment has functioned satisfactorily. The automatic starting and stopping equipment has been used repeatedly, with no failures of any kind to date.

The effect of cooling water temperature on yield has been observed further. When the cooling water temperature was dropped from 68°F. to 45°F., the yield increased 66% over that obtained at 68°F.

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BY *David J. O'Connell* DATE *3/20/96*

*By 75 Standard ADD 3/20/96*

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The dew point of the oxygen made by the unit has been determined. At a time when the Pauling meter showed an oxygen purity of 99.7%, the dew point of the gas was  $-7^{\circ}\text{C}$ . or  $19^{\circ}\text{F}$ .

The performance of the Clark Bros. compressor has been studied. As pointed out in our last report, with the suction side of the compressor running at subatmospheric pressure, the purity of the oxygen was very low. When the suction pressure was raised to 2-3 p.s.i. ga., the purity rose to better than cylinder oxygen and held very steady. Purities of 99.5% to 99.8% have been obtained without difficulty.

During the initial operation with the positive compressor suction pressure, the yield dropped off markedly. This was apparently due to leakage from the chamber under the pistons. Investigation showed that pressures of 20-30 p.s.i. ga. were built up in this chamber. Connecting this chamber with the suction side of the compressor reduced this pressure to substantially the suction pressure. The yield immediately rose. Present operation is at 1 to 1 1/2 p.s.i. ga. suction pressure. This results in an oxygen purity slightly higher than cylinder oxygen.

As discussed in our last report, the use of such suction pressures results in considerable lowering of the units hourly production. On the other hand, the sweeping effect obtained during the flow back of oxygen from the oxygen storage system to the reactor should result in maintaining high oxygen purity during a much longer period of the powder life. This is because most of the residual inerts left in the powder bed after evacuation are swept into the annular space outside of the powder case and never are able to mix with the oxygen delivered to the storage system.

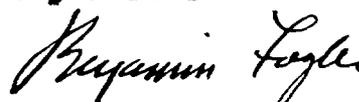
Considerable cutting and welding work has been carried out in Cambridge with the oxygen produced by the unit. It behaves very well in the torch. Operators using it have felt its performance to be definitely superior to cylinder oxygen, giving a hotter flame and a cleaner cut.

Respectfully submitted,



T. L. Wheeler  
Supervisor

7 ccs. to Dr. S. Prentiss  
3 ccs. to Mr. D. Churchill, Jr.  
2 ccs. to Mr. E. P. Stevenson



Benjamin Fogler  
Chemical Engineer.

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