



Valve connections consisted of serrated flanges for convenience. Pipe connections were made by conventional techniques for flow systems. Except for the brass flowmeter, all metal components were of stainless steel.

### Exhaust-Gas Scrubber

The operation of hydrogen-fluorine engines generates toxic combustion products, principally hydrogen fluoride. A rocket exhaust-gas scrubber (fig. 7) was used to remove these toxic products.

Flames from the rocket engine passed through the spokes of a wheel-like manifold in the scrubber. These spokes introduced water directly into the core of the flame and greatly reduced the exhaust-gas temperatures and velocities. The gases were then fed along the horizontal duct into the vertical section. Upon entering the vertical section, the gases were exposed to water sprays from hundreds of nozzles arranged in seven tiers. The gases were scrubbed by this water, which flowed at about 8400 gallons per minute. The resulting hydrofluoric acid solution was collected in a sump pit at the bottom of the vertical section.

The use of the scrubbers presented a problem in using hydrogen. Since the operations of the engine were conducted by using a hydrogen lead and override and by running fuel-rich, excess hydrogen could easily collect and mix with air in the scrubber ducts. If this should occur, an explosion would be inevitable when the engine fired. Therefore, the entire scrubber had to be inerted by replacing all the air with carbon dioxide. This led to the further requirement of monitoring the oxygen content at various stations in the scrubber. No rocket runs were made unless sampling showed less than 3 percent oxygen concentration at each monitoring station.



E-183