Since the production of UO_2 and UF_4 are essentially dry processes dust control is a very important aspect of these operations both from the health angle and the provision against loss of a quite valuable product. An efficient dust removal and collection system is therefore provided.

IV. Metal Operations

Uranium metal is made at Port Hope by the reduction of uranium tetrafluoride or green salt by magnesium metal. The chemical reaction which is similar to the thermite reaction between powdered aluminum and iron oxide used in certain welding techniques and as an incendiary is as follows:

$$UF_4 + 2\ Mg \longrightarrow U + 2\ MgF_2$$

Charge Preparation

The green salt (UF_4) is received from the green salt plant in drums and in the pellet form. It is first pulverized into a powder and enough is segregated and carefully weighed for the preparation of one charge or firing. The amount of magnesium metal required for the charge is next calculated and weighed out.

The two ingredients are then hoisted up in drums and dumped into a twin cone blending machine in which they are thoroughly mixed.

Reactor Vessel Preparation

The reactor vessel used is made of mild steel, is cylindrical with an enlarged top section. The shape and approximate dimensions of the vessel are shown in the sketch appearing on the following page.

Because the reaction occurs at an elevated temperature in the same range as the melting point of steel the vessel must first be lined with a refractory material. The lining material used is the slag from previous firings which has been ground to a suitable fineness. This slag liner material is essentially magnesium fluoride.

A mandrel is placed in the reactor vessel and the vessel with the mandrel in it is placed on a jolting machine. A feed chute is attached at the top which is arranged to feed the liner material into the annular open space between the mandrel and the wall of the reactor vessel. The jolting machine, operated by compressed air, jolts the reactor vessel up and down during filling and the liner powder is firmly packed into place.

When the filling has been completed the vessel is removed from the jolter and the mandrel is carefully removed. The liner, which is now exposed, is quite solid and self supporting. The liner is from $1\frac{1}{2}''$ to $3''$ thick and is thicker at the bottom than at the top.

Charging or Filling

The lined reactor vessel is next placed on a hydraulic lifting ram which is situated directly below the blender containing the mixed charge. A filling line or pipe is fastened to the discharge port of the blender and the reactor vessel is raised so that the filling line extends down into it. A valve is opened which allows the green salt magnesium mixture to flow from the blender down the pipe and into the reactor vessel. A device on the ram now alternately raises and lowers the reaction vessel, raising it one inch then slowly lowering it two inches. The vessel is thus slowly lowered down and the up and down motion tends to consolidate or pack the charge which continues to run in.

When the complete charge has been filled into the reactor vessel the charge is further packed by hand using long rods. Next a cap of the same material as used for lining is tamped in on top of the charge. The thickness of the cap is about $4''$. The steel lid of the vessel is next bolted on and the charge is ready for firing.