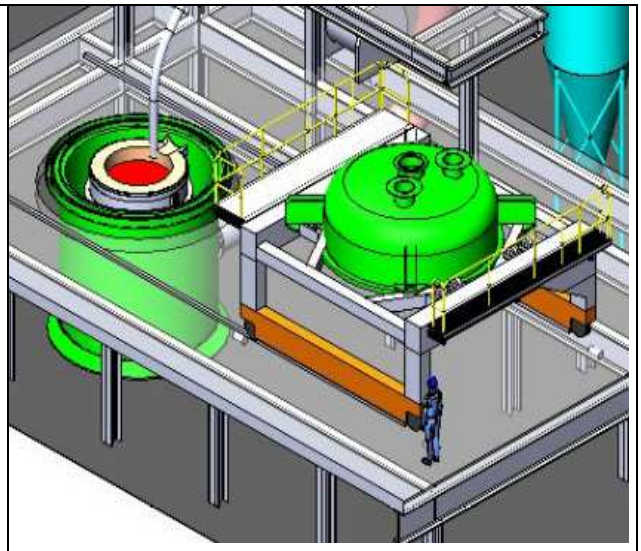
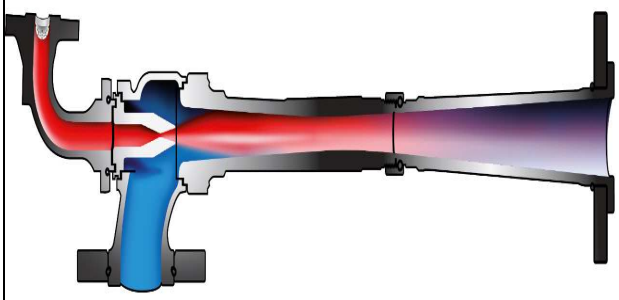
VACUUM STEEL DEGASSING

By Wilhelm Burgmann

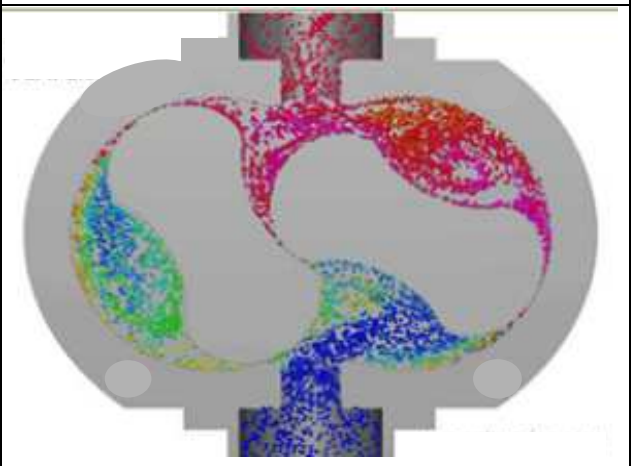
RH



VD



SVP



MVP

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**Dr. - Ing. Wilhelm Burgmann (1939) graduated to diploma of engineering at Aachen Technical High School / Germany and after a stay as research fellow at IRSID / France got a doctor-degree at Berlin Technical University.
His professional steps brought him to Switzerland, Italy, France, Germany and Luxembourg where he was a superintendent in steelmaking shops, project and commissioning engineer for vacuum plants for special steel refining and consultant to vacuum plant manufacturers where he focused on mechanical vacuum pumps.**

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ECO-E AG is a Swiss engineering company dealing with energy saving plants in steelmaking

Steel refining of the past 60 years has led to two important vacuum steel degassing processes – VD and RH. Their oxidising process versions VD-OB, VOD and RHO allow decarburisation of low alloyed and high alloyed steel grades.
All vacuum processes owe their success to the simultaneous use of argon for purging and stirring. They are combined vacuum-argon processes.

The metallurgical part of vacuum degassing plants consists of the reaction recipient that can be an induction furnace, a ladle, a converter or a circulation vessel.
The degassing or decarburisation reactions induce the collateral effect of splashing and dust formation. Therefore the vacuum pump sets must have a pressure control device, the treatment recipients must have a large freeboard or they are to be covered by a heat-resistant lid. The larger ladles are confined in a vacuum tank and the RH-vessels can be particularly high.

The off-gases are not only dust loaded but also hot, mainly in the oxidising process phase. This makes gas cooling and dust abatement in coolers, cyclones and filters compulsory to assure constant pump performances and a long life of the pumps.

Two types of vacuum pumps are available: The steam ejector vacuum pumps (SVP) which are predominant for larger heat sizes and the mechanical vacuum pumps (MVP) which are assembled in multistage sets of endless screws and Roots blowers.
The advantages of MVP- systems over the SVP- units in terms of energy and fluid consumption as well as maintenance and dust disposal are described.
The mystery of the different suction capacities of SVP- and MVP- units can be explained by physical characteristics as well as by operational and economical considerations.
Clear guidelines are given for the pump set rating, considering the pressure losses.

The metallurgical results are excellent for both vacuum pump systems. The VD- tank degassing excels in low contents of hydrogen, nitrogen, sulphur and oxide inclusions. VOD offers the lowest carbon values for high chromium grades while the chromium yield is kept high in strong argon stirring processes.
The RHO – process is unbeaten when low carbon contents are required in a highly productive plant.

The main safety issues are the handling of hot steam and the avoidance of water leaks. The potential for explosive off-gas mixtures cannot be ignored in any process. Explosion protection therefore focuses on preventing ignition sources. For MVP-systems, complete ATEX certified pump sets are industrially proven.
Dust abatement devices satisfy the environmental requirements regarding the residual dust content. Where a CO – post-combustion is required, particular care is to be taken to avoid high NO_x - values.

The return of investment for often expensive MVP- systems is usually a short time for small and medium sized heats and is also demonstrated for the largest plants. This explains the sharp increase of the MVP- share of all vacuum and argon refining plants worldwide in the past 15 years.
The developments in technique and market technology are not finished. The vacuum pumps tend to the 3-stage MVP- units with low energy consumption and emissions, relatively small footprint and space requirement, low maintenance efforts and easy access. The lining cost, an essential part of the operational RH-expenditure, can be reduced by water-cooled elements.