a positive ion collector. Other types make use of the Penning gauge principle to sputter titanium from the cathode(s), and provide heavy ionization. In yet another pump, barium is evaporated on to an extensive water-cooled surface, with a Penning gauge adjoining. In discussing the future of these pumps, the author points out that none have the high and constant pumping speed of oil diffusion pumps of comparable size. Ultimates of the order 10^{-10} mm have been obtained, but usually with systems designed for low degassing rates. There is an advantage in the absence of oil vapours, and small pumps may be permanently connected to sealed-off devices such as magnetrons and X-ray tubes. It is concluded that these new pumps will be used increasingly in research and in the electron industry, but not in applications where very large gas throughputs have to be handled. An appendix discusses definitions of speed and sorptive capacity as applied to gettering agents. There are 63 references. M. D. A.

L. Holland, *J. Sci. Instrum.* **36**, 105–116, March 1959.

21

193. A New Molecular Pump.

A new molecular pump constructed like a turbine is described. An axis rotating inside a cylindrical housing has bearings at both extremities of the housing. To the axis are fixed 19 rotors from the centre towards each bearing mounted so as to interlock with 21 stators fixed to the housing. It follows from this that gas is transported axially from the centre of the rotor to the two ends. The pumping action is achieved by a series of slanting slits cut into the outer perimeter of both rotors and stators.

Some technical data :

- Thickness of rotor and stator disks : some mm
- Radial gap between rotor and housing : 1 mm
- Axial distance between rotors and stators : 1 mm
- Rotor diameter 170 mm, revolutions : 16,000 rev/min
- Power required 0.3 KW
- Overall length of pump : 670 mm
- Speed for air : 500 m^3/h for pressures below 10^{-2} Torr.

The compression ratio is very dependent on the molecular weight of the gases to be pumped. For hydrogen it is 1 : 250 for air 1 : 5 × 10^7. Speed curves are reported showing a region of constant speed of 500 m^3/h between 10^{-2} and 10^{-9} Torr. It is further reported that the ultimate vacuum of the pump is determined largely by hydrogen coming from the steel walls by diffusion or degassing.

In the use of the pump in a high vacuum installation the use of high vacuum and roughing valves can be dispensed with. Both the primary and the molecular pumps may be started simultaneously as it may be assumed that the full number of revolutions of the molecular pump is only obtained when the primary pump has evacuated the vessel to about 10^{-1} Torr and that the final evacuation of the vessel down to the desired ultimate is then taken over by the molecular pump. A sliding coupling prevents overloading of the motor. When pumping at more than 10 Torr the rotational speed is automatically reduced. Below this pressure the pump will attain the full rotational speed.

The following fields of applications for this type of pump are suggested :—

- Manufacture of large transmitting valves for VHF.
- Accelerators for nuclear physics.
- Vacuum systems for mass spectrometers.
- Melting installations for the highest degree of purity.

Furthermore it is thought that the pump may be employed in the separation of light isotopes because the compression ratio for normal hydrogen is only 1 : 250 rising to 1 : 2400 for heavy hydrogen (separation factor 9.6).

W. Becker, *Vakuum-Technik* **7**, 149–152, 1958.

21

194. Removal of Gases in High Vacuum Systems by Metal Abrasion.

United Kingdom. Gettering is a well-known process for the removal of free gas in vacuum devices, but removal can cease once a thin protective layer of reaction product has been formed. A method had been devised for removing the protective film from a reactive metal such as titanium by abrading the surface, so that a continuous take-up of gas is obtained.

Letter by M. E. Haine, E. W. R. Francis and R. N. Bloomer, *Nature* **182**, No. 4640, 931, 4 Oct. 1958.

22. Gauges

22

195. Liquid Manometer with Electromagnetic Balance Indicator.

S. Africa. The paper describes the construction and operation of a null-reading type of liquid manometer, which utilizes an electromagnetic device for balance indication, and a set of analytical weights for indirect " weighing " of the unknown differential pressure. The apparatus was designed specially for measurements in the range of differential pressures below 5 mm water gauge. The probable error under laboratory conditions was found to vary from less than 0.01 mm water gauge at maximum range, to about 0.0005 mm water gauge at a differential pressure of 0.01 mm water gauge. Apart from its normal applications as a manometer, the apparatus can be used as an indicator of the flow dynamic head in low-speed wind tunnels. (Author)

J. F. Kemp, *J. Sci. Instrum.* **36**, 77–81, Feb. 1959.

22

196. Construction of a Mcleod Type Vacuum Gauge having a Linear Scale.

G. Haase, *Chemische Technik* (Beiblatt Glas-Apparate-Technik) **10**, 37–39, 1959.

22

197. Pressure Gauge for Corrosive Gases in the Micron and Submicron Region.

Australia. For use with corrosive gases in the range 10^{-2} to 10^{-5} Torr a gauge is described in which the pressure is indicated by the rate of damping of a hinged silica fibre pendulum, the amplitude of which is measured photoelectrically. The gauge exposes only glass and silica to the gas, may be baked 450 °C, and gives an accuracy of pressure measurement of better than 5 per cent. (Author)

J. R. Anderson, *Rev. Sci. Instrum.* **29**, No. 12, 1073, Dec. 1958.

22

198. Investigations of Radiometer Forces in the Pressure Range 10^{-3} to 3 Torr.

Experiments are described with the thermal-molecular vacuum gauge of Klumb.

H. Klumb und D. Fuchs, *Vakuum-Technik* **7**, 131–135, 1958.

22

199. Vacuum Gauges in Glass.

A discussion of pressure units and pressure ranges below 760 Torr is followed by an historical survey of the different groups of gauges. A detailed treatment is given on : U-tube, membrane, capsule, bourdon-tube, micro-manometer, further : compression —(e.g. McLeod, rotary) vacuum gauges, as well as barometers. The details of construction and design of these instruments are dealt with.

H. Wilhelm, *Sprechsaal* **91**, 233–236, 267–270, 285–288 and 308–311, 1957.

22

200. Thermocouple for Vapor Pressure Measurement in Biological and Soil Systems at High Humidity.

L. A. Richards and Gen Ogata, *Science* **128**, No. 3331, 1089–1090, 31 Oct. 1958.