In this issue

Morris Travers (1872–1961)

One must congratulate the Indian Institute of Science on having instituted Morris Travers Memorial Lecture (page 354) in memory of its first director. Travers was a very remarkable man, scientist and engineer. His record was enviable and difficult to match: the discovery of three new elements, applications of many aspects of chemistry to industry, the strengthening of a university in England, and laying the ground rules for a research institution in India so that it could become great.

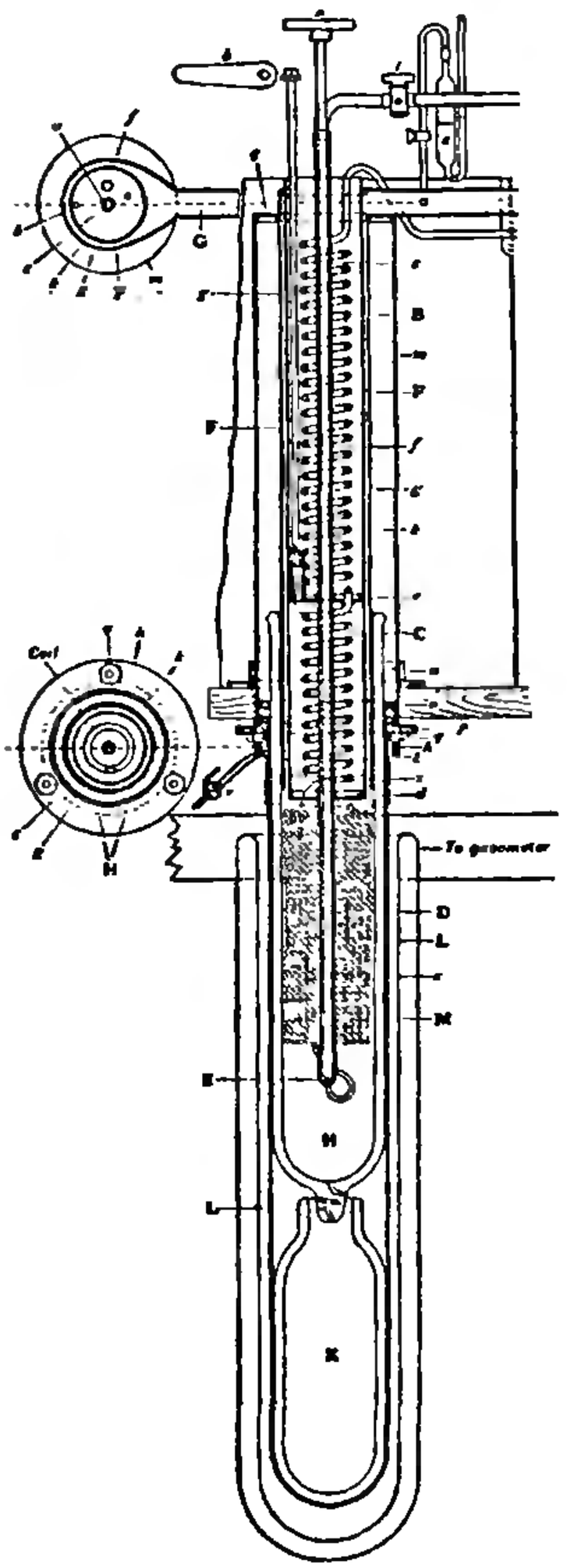
In the summer of 1894, William Ramsay (along with Lord Rayleigh) discovered argon. Almost immediately Travers joined Ramsay to study the properties of this new element. Theirs was a great and ideal collaboration 'in the search for missing element or elements which the Periodic Law indicated should exist'. Their first paper was entitled 'Helium, a constituent of certain minerals'. Later came the discovery of krypton, xenon and neon (in that order) and the arduous work of separating the gases using liquefaction techniques and showing them to be monatomic. Travers was elected to the Royal Society at the early age of 32, and Ramsay was knighted and later awarded the Nobel Prize (1905). From 1906 to 1914 Travers was in India; about this later.

Travers discovered a method of preparing acetylene from calcium carbide, anticipating Moissan—who is usually given credit for this. Important industries were established in Great Britain on the basis of this work. He did much for the development and production of scientific glassware. He was involved in the design of many chemical engineering plants and the fabrication of small and large furnaces, especially for the glass and ceramic industry. His work on the thermal decomposition of organic vapours, production of water gas and coal gassification attracted much attention. He was the recipient of the Medal of the Institute of Fuel (which was also awarded to Homi Bhabha!). For his contributions to the glass industry, Travers was elected Honorary Fellow of the Society of Glass Technologists—of which he became the President. He was also the President of the Faraday Society (1936–1938).

In 1956 Travers wrote a lucid biography of his mentor (and hero) Sir William Ramsay and a beautiful account of the *Discovery of the Rare Gases*. In reviewing this book, Christopher Ingold used such expressions as 'enthralling··· vivid, cogently documented, thorough and technically precise'. He ended by saying, 'In this volume [written by Professor Travers] between his eighty-first and eighty-third birthdays, with all the strength of a man in his prime, we find a remarkable combination of high literary merit, good history and excellent science'.

Because he excelled as an experimental scientist, had an aptitude for applied science, a profound knowledge of university administration, and had done yeoman service to the Bristol University, Ramsay suggested that Travers take up the directorship of the newly founded institution in India, which had not yet been named, 'consequent on the bequest of the late J. N. Tata of Bombay'. He was to start a nucleus of scientific and technical departments which would develop on the lines of the Imperial College of Science and Technology, London. He was offered a salary of £ 1800 p.a., a free house, etc. His salary in England was £ 350 p.a. and 'out of this he had to meet considerable expenses in connection with his researches'. Even so he was reluctant to take up the Indian position but was finally persuaded to accept.

He did an excellent job starting with the layout of the Institute followed by designing and getting constructed many of its major buildings and laboratories. Over the years the Institute developed along the lines he had laid down. Much credit is due to him for 'his wisdom,



Trever's hydrogen liquefier

farsightedness and thoroughness in planning'.

In England he was described as a very capable administrator, who liked things done quickly and one not tolerant of inefficiency. He lived up to this description even in Bangalore. However, *in India, he was described as a person* wanting in administrative skills and who did not have the tact needed for the direction of an institution. In my view, this was a euphemistic way of saying that he was not willing to kowtow to the powers that were. The Tata family and the Council of the Indian Institute of Science made his life intolerable so that he actually wrote, '··· to put an end to the continuous "ragging" of the director ··· which has become a disgraceful feature of the Council meetings ···'. So reminiscent of what happened to C. V. Raman, a director, 25 years later. Travers was an inveterate letter-writer. I remember Raman showing me a letter in which Travers wrote saying that Raman need not feel specially honoured that he had been singled out for illtreatment by the Council; this game had started much earlier but a quarter century of practice had probably made them perfect. It seems that between the great J. N. Tata and the remarkable J. R. D. Tata, the 'family' seemed to have been short of persons with imagination and tolerance. It was sad that they had advisers who were 'all-knowing' and the ultimate bureaucrats; sadder still was that some of these who had no inkling as to what produces scientific creativity became Chairmen of the Council. One is tempted to speculate had J. R. D. been the President of the Court, and the gentle and wise Choksi the Chairman of the Council during the days of Travers or Raman what benefits the Institute would have derived from these two impatient geniuses.

James Dewar claimed that he produced liquid hydrogen in 1895 but no description of the apparatus or the procedure was ever published. Travers set out to liquefy hydrogen in quantities required for real experiments. He modified a small air liquifier (*Philos Mag.*, (6) **1**, 411) and the apparatus operated successfully and produced enough liquid hydrogen to fractionate a helium–argon mixture. Legend has it that the air liquefier which was in the central workshop of IISc was set up by Travers. We have often observed Raman 'watching the kettle' impatiently for the production of liquid air by this machine for his spectroscopic and X-ray studies. We have also seen the attachment for liquefaction of hydrogen kept in an almirah along with its blue prints. In 1903 Travers took his liquefier to Berlin and produced liquid hydrogen for the first time in Germany. This original and historic hydrogen liquefier is now in the Science Museum, South Kensington. The one which *probably* produced liquid hydrogen in India for the first time (*circa* 1910) ended up, we understand, in the scrap heap. Do we require a law similar to that enacted by Curzon—(the protection of ancient monuments)—if what scientific heritage we have is not to be lost. One cannot forget that Mahendra Lal Sircar's Indian Association for the Cultivation of Science at 210 *Bow Bazaar Street, Calcutta, which to* us was what the Royal institution is still to the British, was callously knocked down after independence.

Few in India know that it is at the Indian Institute of Science (1911–1914) that Travers (along with N. M. Gupta and R. C. Ray) did the pioneering work on boron and its compounds. He wrote, 'I believe that the study of boron is of utmost importance to chemistry as many of the conventional concepts do not seem to work in its compounds'. We could do with a history of the Indian Institute of Science that deals with the innovative science that was produced there over the years.

Yes, Travers was quite a remarkable man, always excited about science whether it was done by him or by others. To him every new result was a discovery, something exciting, to be talked about and discussed. He was feverishly active all the time and never relaxed except when he was in his home with his family or with his music. From accounts long ago, he apparently had wonderful musical evenings in his elegant drawing room with an open log fire which, we are told, Bangalore needed in those days!

XXXVII. *The Liquefaction of Hydrogen.* *By* MORRIS W. TRAVERS, *D.Sc., Fellow of University College, London*.*

[Plate V.]

[*Note by* Prof. Ramsay.—In the course of our researches on the gases of the atmosphere, it became evident that the only means of separating neon in a state of purity from the helium with which it was mixed, was by cooling the mixture of the two gases by aid of liquid hydrogen at its boiling-point under atmospheric pressure. In order to effect this separation, Dr. Travers undertook to design and make an apparatus which would produce liquid hydrogen in quantity; and the following account of the experiments shows that his hopes have been justified.]