for the normal state the C (0,0), (0,1) and D (v',2), (v',3), (v',4) bands[8] were used. With these and the C (1,1), (2,2) bands, with heads at 26,380 cm^{-1} and 26,495 cm^{-1}, respectively, the vibration constants of the C state were calculated (Table II). These gave for the dissociation value: by Rydberg's method, $D=10{,}000$ cm^{-1}; linear extrapolation, $D=18{,}200$ cm^{-1}. Since neither of these agrees with the position of an atomic state of Sr, one concludes that the ^3S, occurring at about the average, is more likely than any other to be the state of excitation of the atom after dissociating from the C state. This would indicate an electron configuration[9] of the molecule in the C state of $5s\sigma^2 6s\sigma$. The dissociation values for all the known states of SrH, obtained from products of dissociation, are listed in Table III.[10]

We wish to thank Dr. A. J. King for generous supplies of pure metallic strontium.

[8] See reference 4. The (v',4) of the D system, located at 16,272 cm^{-1}, has not yet been reported.

[9] This configuration differs from that assigned by Grundström (reference 3), but the difference might possibly be due to a typographical error.

[10] These values differ somewhat from those listed by Grundström (reference 3) though the methods used were identical.

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Mass-Spectrograph Analysis of Beryllium

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A new source of ions suitable for positive ray analysis was developed in the form of a molecular beam from a hot oven. Ions were produced in the beam by electron impact and focused on the entrance slit of the mass spectrograph by suitable electric fields. The method was applied to the study of beryllium but only Be^9 was found. The experiment placed an upper limit on the existence of Be^8 of one part in ten thousand.

ALTHOUGH most of the lighter elements have been satisfactorily investigated, analyses of the isotopic constitution of beryllium have not yielded consistent information. Watson and Parker[1] have reported the existence of Be^8 in an intensity ratio $Be^9 : Be^8 \doteqdot 2000 : 1$ from a study of the band spectra of BeH. On the other hand, Olsson[2] failed to observe any Be^8H lines on heavily exposed photographs of the bands. Aston's[3] analysis by means of accelerated anode rays, using BeF, has given no conclusive results because of the difficulty of obtaining sufficient intensity. Furthermore, while Be^8 appears presumably as a disintegraion product of at least five nuclear reactions,[4] two, or possibly three, of these would be satisfied by the existence of a stable Be^8 nucleus, although an alternative explanation has recently been suggested.[4] From these considerations it would seem of some importance to be able to set an upper limit for the relative abundance of Be^8 in natural sources of beryllium. Our investigation was undertaken with this end in view.

The apparatus used is that described by Blewett.[5] The glass tube carrying the ionization chamber and electron filament was modified in order to permit the introduction of a small furnace in a manner shown in Fig. 1A. The furnace O can be inserted through either of the ground glass joints as indicated in the figure. It consists of a cylindrical spiral T, Fig. 1B, made from a strip of 1- or 2-mil tantalum, 2 cm long, 8 mm wide spot welded to two nickel rods which are supported by tungsten leads. The lip extending over the side serves to partially collimate the vapor stream. It has been found desirable to use a radiation shield N, usually of sheet nichrome, to protect the glass walls and to reduce sputtering as much as possible.

A 1-kw 120/20-volt transformer supplies the

[1] Watson and Parker, Phys. Rev. **37**, 167 (1931).
[2] Olsson, Zeits. f. Physik **73**, 732 (1932).
[3] Aston, *Mass Spectra and Isotopes*.
[4] Wells and Hill, Phys. Rev. **49**, 858 (1936).

[5] Blewett, Phys. Rev. **49**, 900 (1936).

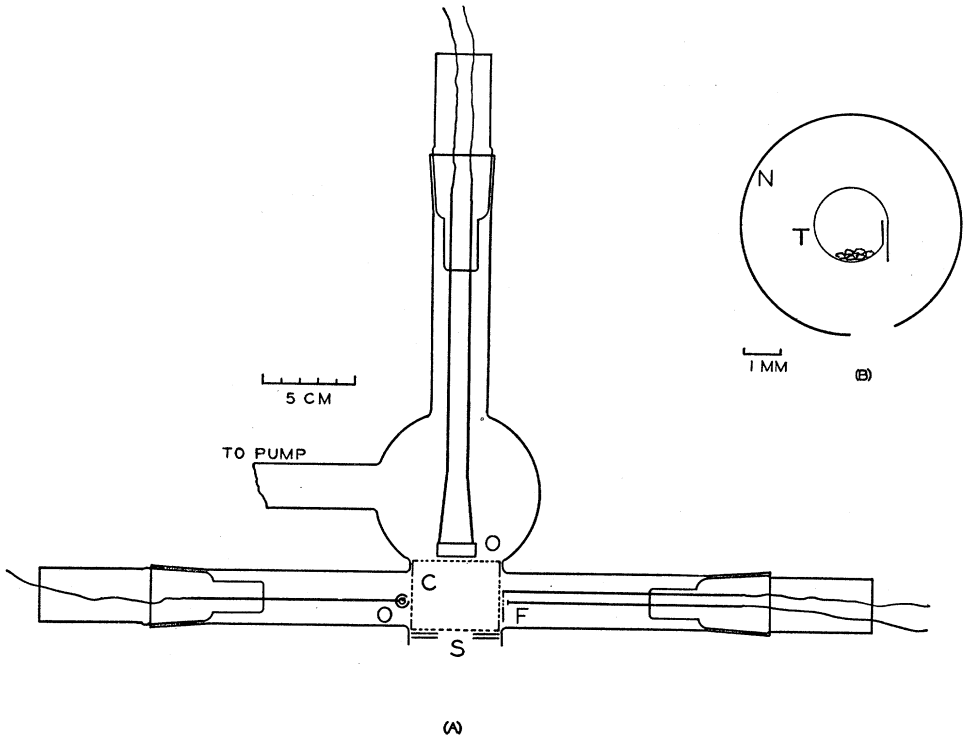

FIG. 1. A. Electrode arrangement of the ion source. B. Enlarged cross section of the furnace.

current (between 15 and 25 amperes) which passes directly through the tantalum strip. The metal under investigation is placed in contact with the furnace and vaporizes when it reaches the proper temperature. Ions are formed in the molecular beam entering the ionization chamber *C*, Fig. 1A, by electrons accelerated from the tungsten filament *F*. The ions are then accelerated into the analyzing chamber through a slit system *S* in the usual fashion.

To test the practicability of this arrangement, the furnace was packed with copper filings and heated to about 1000°C. Peaks of the order of several thousand divisions on the detecting instrument were easily obtained. It may be noted in passing that the presence of argon in the tube augmented the size of the Cu^+ peaks to an astounding degree, an effect probably caused by collisions of the second kind.[6] This supposition was substantiated by the disappearance of the effect below the ionization potential of argon.

Beryllium proved slightly more troublesome because of the degassing of the glass walls. A small electric fan, however, served to keep the walls as well as the waxed joints quite cool. Peaks as high as 13,500 divisions on our scale (2.7×10^{-11} amp.) were obtained and a search made for Be^8. The ionization efficiency was a maximum between 40 and 45 volts, so that in this range the presence of O_{16}^{++}, whose appearance potential is about 50 volts, was not possible. The background was negligible and the peaks sufficiently separated so that the tail of the mass 9 peak disappeared completely before the mass 8 position was reached. Repeated runs failed to reveal the presence of any ions at the mass 8 position. We believe this experiment places an upper limit on the existence of Be^8 of 1 part in 10,000 of Be^9. A small peak was observed at the mass 10 position, but since its size bore no definite relation to that of the mass 9, it was attributed to the presence of a small amount of BeH^+.

The success of the present method leads us to hope that it will now be possible to investigate heavier metals which have heretofore been difficult to handle by other means.

[6] Duffendack and Black, Phys. Rev. **34**, 35 (1929).