to give a complete explanation of the numbers of extra electrons required in the heavier elements.

With the addition of the extra electrons the proposed nuclear structure becomes a diamond type lattice of electron pairs joined by protons.

The method of coupling proton spins appears to be that demanded by the quantum mechanic rule for vector combination.

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NOTE

Filtering Disks of Sintered Pyrex Glass.—The recent development of the use of sintered Jena or quartz glass disks and alundum plates for filtration, in addition to numerous other applications,[1] makes it very desirable to devise similar material which can readily be fused to pyrex glass. For some time alundum disks have been used in pyrex apparatus, but it is very difficult to obtain a dependable Alundum to pyrex contact. The fact that the two materials have different coefficients of expansion results either in an imperfect junction or in a dangerous strain even after the most careful cooling. The use of sintered pyrex disks would avoid these difficulties. Although these plates are not available from commercial sources, we are able to recommend a procedure whereby a person can, with a little care, prepare for himself satisfactory filtering disks of sintered pyrex.

Scrap pyrex glass crushed to a convenient size is ground to a fairly fine powder either in a pyrex or porcelain mortar or in a grinding machine. The powder is separated into several portions by sifting, *e. g.*: (a) the coarse material which will not pass through a sieve with sixty meshes to the inch, and which should be reground; (b) the part that passes a sixty-mesh sieve, but not an eighty-mesh sieve, and which can be used for making coarse-grained filters; (c) the particles which fall through an eighty-mesh sieve, but do not pass a one hundred-mesh net; (d) the fine powder which is not held by a one hundred-mesh sieve. When a metallic grinding machine is used, the third and especially the fourth portions are contaminated with finely divided metal which gives the disks a grayish cast unless it is removed by acid before sintering.

The apparatus for sintering includes a cylindrical mold, for which we used about one centimeter of nickel tubing with an internal diameter of one centimeter. As indicated in the figure, this cylinder rests on a nickel plate about two and a half centimeters square. The plate may be made large enough to accommodate molds of various sizes if this is desired. In suitable holes drilled at the corners of the plate are fastened nichrome wires arranged to serve both as a handle and as a guide and stay for the

[1] **Prausnitz**, *Arch. Pharm.*, **268**, 170–184 (1930); *Chem.-Ztg.*, **53**, 935–6 (1930).

cover. For this we used a second nickel plate, drilled like the first, sliding it up and down on the wires. A layer of glass powder one and a half to two millimeters thick is then placed in the cylinder and is leveled by gently tapping the container. The cover is put in place and the apparatus is set in a muffle furnace kept at a bright red heat. A little experimentation will give the temperature which gives a sintered disk in about two minutes. If the temperature is too high or the time of sintering too long, a non-porous lump of glass results; if the temperature is too low or the time too short, the disk is weak and friable. The metal of the mold comes to the temperature of the furnace in about a minute, and in the case of the coarse particles of portion (b), another minute is required for satisfactory sintering. The finest powder requires approximately one minute and forty-five seconds from the time the apparatus is put in the furnace. The apparatus is withdrawn from the furnace promptly and is set on a metal plate to cool. The cylinder containing the disk is then removed and inspection shows that, with the two smaller sizes in particular, a slight shrinkage away from the sides of the mold has occurred near the upper part of those disks which are satisfactorily sintered. The disk is quite rugged enough to be pushed out of the mold with a wooden rod. Any uneven places can readily be smoothed down by a file.

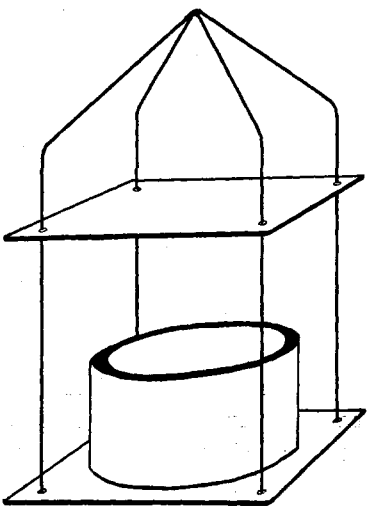

Fig. 1.

For sealing the disks to pyrex apparatus, a pyrex tube of slightly larger diameter than that of the disk is given a slight taper. The disk, inserted in the tube, is supported by the taper and, if necessary, is held straight by a glass rod with a flat end. By careful application of a small hot flame, the disk is attached to the tube at several points. Pushing the hot glass against the side of the disk by means of a nichrome wire may be used to hurry the process. The seal is completed either by rotating the tube in a small hot flame and drawing it down over the disk, or by blowing the glass around the plate in and out in the usual way of making a glass to glass seal. A flame of air and gas is preferable to one of oxygen and gas for this purpose.

Disks ten to fifteen millimeters in diameter made according to these directions have been in use for some time and have given entire satisfaction. Those made from particles of portion (b) hold by capillarity a column of mercury ten centimeters high. Filters made from the fine powder in portion (d) will hold mercury at half an atmosphere. The sole

precaution which we have found necessary is to wrap the filter with asbestos paper if it is to be heated to a high temperature in a vacuum. This protection should also be used to provide slow cooling for a hot filter.

CONTRIBUTION FROM THE
CHEMICAL LABORATORY OF
HARVARD UNIVERSITY
CAMBRIDGE, MASSACHUSETTS

W. F. BRUCE
H. E. BENT

RECEIVED JANUARY 14, 1931
PUBLISHED MARCH 6, 1931

[CONTRIBUTION FROM THE LILLY RESEARCH LABORATORIES, ELI LILLY AND COMPANY]

SOME NEW WATER-SOLUBLE ORGANO-MERCURY COMPOUNDS[1]

BY JOHN H. WALDO

RECEIVED JUNE 16, 1930 PUBLISHED MARCH 6, 1931

Introduction

The application of organo-metallic compounds in the therapeutic field too often has been limited by their insolubility in water. Organic mercury compounds having the mercury attached to a carbon atom have had considerable use in therapy, especially as germicidal agents, although the introduction of the —HgX group into an organic molecule tends to make the resulting compound insoluble in water. When mercury compounds are rendered soluble in water or dilute alkali solutions through the introduction of a sulfonic or carboxylic acid group, they generally become less toxic but undergo a marked reduction in their germicidal activity. However, if nitrogen-containing groups are introduced to give the desired solubility, the germicidal activity is retained, but they are many times more toxic than the group which contains an acid radical.

In 1922, Kharasch[2] developed a method whereby organo-metallic compounds can be made water soluble by condensing them with mercapto-carboxylic or sulfonic acids.

When mercurials of the type RHgX, where X is an inorganic radical, react with a mercapto acid, HSR′, where R′ is a group containing an alkyl or aryl carboxylic or sulfonic acid, a double decomposition occurs

$$RHgX + HSR' = RHgSR' + HX$$

The new compound RHgSR′ is soluble in sodium bicarbonate solution and forms with the alkali metals soluble salts whose solutions are in general stable and do not give an immediate precipitate of mercuric sulfide with ammonium sulfide.

[1] A portion of this paper was presented before the division of Medicinal Products at the Detroit meeting of the American Chemical Society, September, 1927, by M. S. Kharasch, H. A. Shonle, and John H. Waldo.

[2] M. S. Kharasch, U. S. Patent 1,589,599, reissue 16,921.