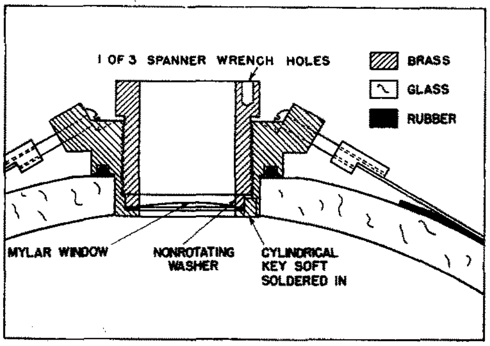

FIG. 1.

tension of four thin, stainless-steel bands connecting the two window holders externally, two around each side of the 13 in. o.d. of the glass cylinder. These bands were near the outer edges of the cylinder so that a $1\frac{1}{2}$ in. high slit, between the two bands on each side, was available to transmit light for picture taking. Rubber strips were used between the bands and the glass cylinder to distribute strains in the glass. This design was the result of a suggestion by Ernest Englund.

* Supported in part by the U. S. Atomic Energy Commission and the Office of Naval Research.

[1] E. R. Gaerttner and M. L. Yeatter, Phys. Rev. 83, 146 (1951).

High Pressure O-Ring Piston Packings

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(Received August 24, 1954)

A VARIETY of piston packings for operation at a pressure level of 10 000 atmospheres has been described, of which the Bridgman[1] unsupported area packing and the Poulter[2] plug are the simplest and most practical.

The Bridgman packing, although eminently successful, requires replacement of machined washers from time to time. Furthermore, when it is used in a pressure vessel over an extensive period and a leak occurs, the head of the packing may get jammed in the belled-out section of the cylinder which is exposed to the highest pressure. Under these circumstances, a set of extracting tools must be available to perform the tedious operation of removing the piston head. The operation may also be avoided by constantly honing the cylinder wall, a procedure, however, even more time-consuming and expensive.

The Poulter plug, which consists simply of a truncated, inverted rubber stopper, is easily available and readily replaced. It tends, however, to be mechanically unstable so that often several attempts are required to attain a successful seal.

The author has sought a compromise to these difficulties by the use of Neoprene O rings as piston packings. Initial efforts were centered on pressurizing 3 centistoke silicone oil by the use of one O ring mounted peripherally on the moving piston shown in Fig. 1. The clearance between the piston and the cylinder wall was 0.001 in. Such packings failed inevitably but erratically around an average pressure of 2000 atmospheres. However, when two O rings were used in series no difficulty was encountered in obtaining pressures to 10 000 atmospheres. Apparently, the oil leaks past the first O ring to a point where the pressure between the two rings substantially enhances the strength of the first ring but is insufficient to cause a leak at the second ring.

The same principle may be used by mounting the O rings as stationary packings in grooves cut into the bomb wall.

Such packings have been found to hold even after the pressure has been cycled from zero to 10 000 atmospheres ten times and held at the higher pressures for a period of a few days.

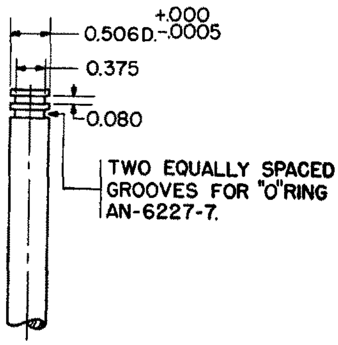

FIG. 1. Piston carrying O-ring grooves in tandem to seal against 10 000 atmospheres pressure.

It should be noted that the O rings are not mounted in the manner recommended by their manufacturer. Normally, O rings are mounted so that they have some measure of lateral freedom in the groove retaining them. The grooves used by us have dimensions such that at zero pressure there is no lateral freedom. Under these circumstances, the O rings are considerably stiffer

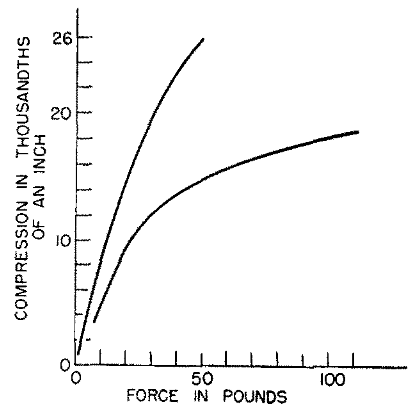

FIG. 2. Compression-force characteristics for O ring with lateral freedom (upper curve) and for O ring with no lateral freedom (lower curve).

than when mounted in the normal manner. Typical force-compression curves for the two cases, kindly provided by T. J. O'Donnell and J. Getzholtz, are shown in Fig. 2.

The author has found such packings simple, cheap, and reliable for many laboratory applications. They possess, however, two notable limitations; they must operate near room temperature, and they must operate in a fluid medium like silicone oil which does not swell or otherwise attack the Neoprene appreciably.

[1] P. W. Bridgman, *The Physics of High Pressures* (Bell & Company, London, 1933).
[2] T. C. Poulter and R. C. Ritchey, Phys. Rev. 39, 816 (1932).

A New Type of Absolute Manometer

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(Received September 17, 1954)

A NEW type of absolute manometer has been developed which simplifies the operations of filling, degassing, and cleaning. The basic improvement over the conventional closed-end absolute manometer is the use of a leakproof needle valve of Teflon tetrafluoroethylene resin in place of sealing off the dead-end leg of the manometer. A standard glass stopcock will not operate satisfactorily as the closure since there is always slow leakage that

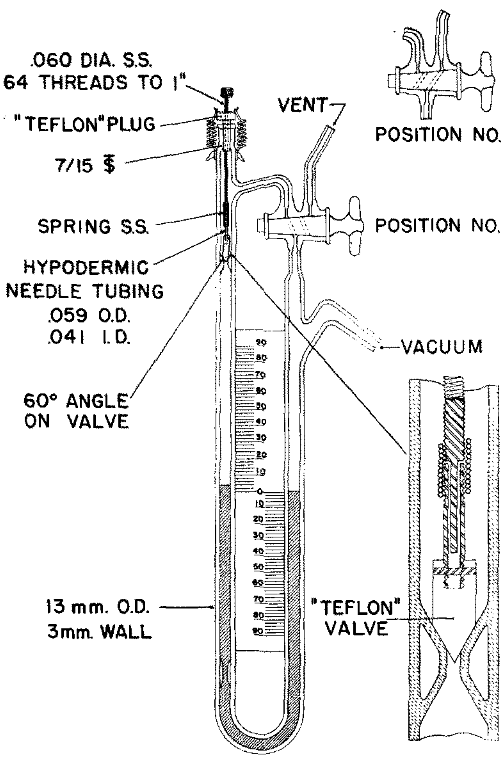

FIG. 1.

admits gas to the dead end of the manometer. The construction of the manometer is illustrated in Fig. 1.

Heavy-wall Pyrex brand glass tubing is used in constructing the manometer; this is particularly important at the 7/15 grind to prevent breakage due to expansion of Teflon. The Teflon plug for the 7/15 standard grind is machined to the correct taper. It is important that the threads cut on the 0.060-in. diameter stainless steel valve stem be very clean and free of defects. The companion threads through the Teflon plug must also be perfect to insure that the resulting seal will be tight. The spring connecting the valve stem to the shank of the Teflon valve is turned in the opposite direction from 0.025-in. diameter stainless steel spring wire using a No. 74 drill as a mandrel. The shank of the Teflon valve is made of hypodermic needle tubing and is attached to the Teflon valve by conventional threading of the companion parts and locking in place with a stainless steel pin. The end of the Teflon valve is machined to a 60° angle. The companion glass surface at the top of the orifice is made by conventional lathe grinding using No. 600 Carborundum abrasive and a brass rod with a 60° angle tip.

The novel feature of the new manometer is the Teflon valve, which provides an absolutely tight seal. The advantages of this manometer are that: (1) the manometer is easy to fill with mercury or oil, (2) the liquid columns can be pumped down under equal pressure and heated to get complete degassing, (3) if during use any gas should collect at the closed end, it is readily removed by opening the Teflon valve, and (4) if the liquid being used in the manometer becomes dirty, it is a very simple matter to empty the manometer, clean the glass, and refill with clean liquid. A skilled technician is not required for the operations of emptying, cleaning, and refilling the manometer since these are performed so readily. The manometer may be used with a variety of liquids such as mercury or oils having low vapor pressures.

In order to fill and operate the manometer the following procedure is used:

(1) Remove the Teflon plug and valve assembly and add mercury or other liquid until the level in the two columns is approximately ½ in. above the mid-point. Replace the Teflon plug and valve assembly and make sure that the 7/15 grind is tight.

(2) Open the Teflon needle valve and turn the two-way stopcock to position No. 1 (see Fig. 1).

(3) Apply vacuum to degas the mercury or other liquid. If mercury is used, heating is advisable to remove traces of moisture or other vapor.

(4) With the unit still under vacuum turn the two-way stopcock slowly to position No. 2, which will admit air and force the mercury to rise in the left leg of the manometer. When the level of mercury rises about ½ in. above the Teflon valve, close the needle valve tightly.

(5) Turn the stopcock back to position No. 1 and proceed with the use of the instrument in the same manner as for a conventional absolute manometer.

(6) If at any time a bubble appears at the top of the mercury column in the left leg of the manometer, repeat steps 2–5.

Erratum: Simple Controller for a Platinum Furnace

MYRON B. REYNOLDS

[Rev. Sci. Instr. 25, 838 (1954)]

THE equation should read:

$$\frac{1}{E}\frac{de}{dt_t}=\frac{R_1}{(R_1+R_F)^2}\cdot\frac{dR_F}{dt}=\frac{\alpha_t R_1 R_F}{(R_1+R_F)^2}.$$

New Instruments

W. A. Wildhack: Associate Editor in Charge of this Section, with the assistance of Joshua Stern
National Bureau of Standards, Washington, D. C.

These descriptions are based on information supplied by the manufacturer and in some cases from independent sources. THE REVIEW *assumes no responsibility for their correctness.*

Direct Reading Spectrometer

The "Atomcounter," a new direct reading spectrometer, has a double optical system and focal deck so that it may be used photographically for qualitative or semiquantitative analysis, simultaneously with or alternatively to the direct reading measurements. It is also furnished as a single deck direct reading system for use in the analysis of simple steels and cast iron. Complete analyses normally require less than one minute. Results are said to show standard deviations of 1–2 percent.

The spectrometer unit consists of a Wadsworth 1.5 meter stigmatic concave grating mount, with a 30 000 line/inch ruling giving 5.3 A/mm dispersion and good intensity over a range of 2300 to 4300 A. Two collimating mirrors are utilized to produce two identical spectra, one above the other, each at full intensity. This feature makes it possible to measure two lines very close together, one in the lower spectrum, the other in the upper, provides double the normal space for mounting photomultipliers, and makes it possible to employ photomultipliers directly behind almost all lines, without the need for one or more mirrors for each channel to deflect the light onto the appropriate photomultiplier.

All functional components are mounted in a steel "L" frame which is supported by an outer frame that is well insulated to minimize the effects of temperature change.

The excitation unit provides both a high voltage spark with auxiliary air-quenched gap and an ac arc. The transformer of the