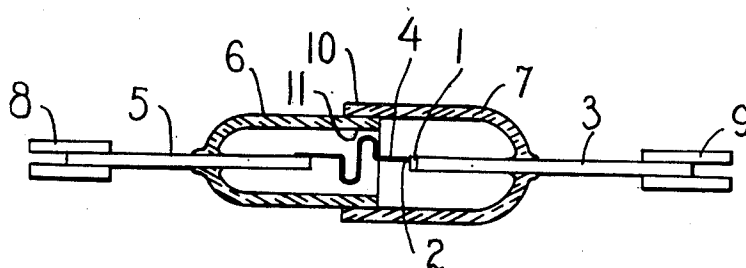


Jan. 27, 1953

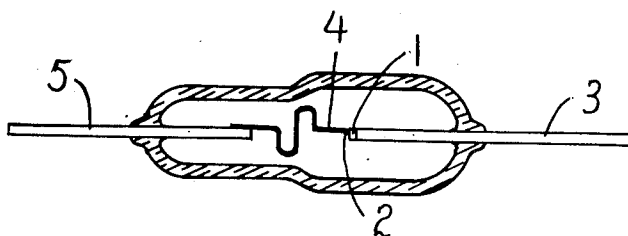
P. E. GATES  
ELECTRICAL CRYSTAL UNIT

2,626,985

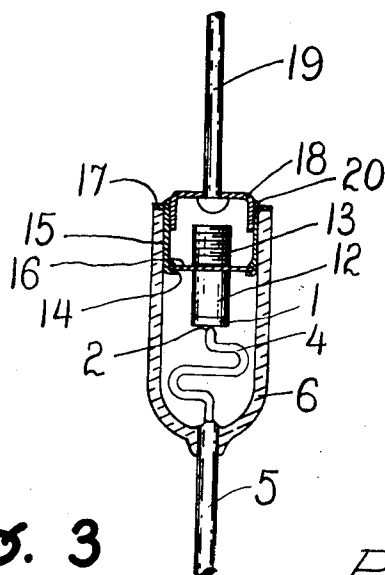
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*Fig. 1*



*Fig. 2*



*Fig. 3*

INVENTOR.  
*Paul E. Gates*  
BY *Lansome Brown,*  
ATTORNEY

## UNITED STATES PATENT OFFICE

2,626,985

## ELECTRICAL CRYSTAL UNIT

Paul E. Gates, Danvers, Mass., assignor to Sylvania Electric Products Inc., Salem, Mass., a corporation of Massachusetts

Application August 25, 1948, Serial No. 46,145

2 Claims. (Cl. 175-366)

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This invention relates to semi-conductor crystal units and the like, for example crystal rectifiers, amplifiers, oscillators and similar devices. The present application discloses features also disclosed in co-pending application Serial No. 50,637, filed September 22, 1948 by Ralph B. Collins, Jr., and in a continuation thereof, Serial No. 74,768, filed February 5, 1949, assigned to the owner of this application. The present application also discloses a construction generically claimed in my copending application, Serial No. 80,358, filed March 9, 1949.

An object of the invention is the achievement of a small, compact, inexpensive crystal unit of improved electrical characteristics.

A feature of the invention is the enclosure of the crystal in a glass tube sealed at its ends by metal contact pieces extending therethrough.

Other features, objects and advantages of the invention will be apparent from the following specification taken in conjunction with the attached drawings in which:

Fig. 1 is a sectional profile of a device being made according to the invention.

Fig. 2 is a profile section of a completed device according to the invention; and

Fig. 3 is a profile section of another embodiment of the invention.

In Figs. 1 and 2 the crystal 1, of a semi-conductor material such as germanium or silicon, together with suitable impurities such as tin or aluminum, respectively, for example, and having a flat surface 2, is soldered or otherwise affixed at its other surface to the metal-wire or pin 3. A catwhisker point-contact element 4, for example as shown in the copending application Serial No. 492,163 of E. T. Casellini, is in contact with the crystal surface 2, and is attached to the wire 5, sealed through the cup-like glass pins 6, which is in overlapping contact with the similar glass piece 7 over which it fits, and through which wire 3 is sealed. The wires 3 and 5, respectively are gripped in chucks 9 and 8, outside the glass envelope formed by glass pieces 6 and 7. These chucks 8, 9 may be adjusted laterally, in the manner usual in lathes and the like for example, until the pressure on the contact between the wire and crystal has its proper value, and the chucks may be capable of motion in other directions, if desired, to permit the catwhisker 4 to be moved over the crystal until a satisfactory contact point is found. Heat may then be applied to the overlapping portions 10, 11 of the glass pieces 6, 7, to seal them together. The resultant is shown in Fig. 2. The

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envelopes 6, 7 need not be evacuated. A filling of ordinary air at atmospheric pressure is generally satisfactory, although other fillings may be used if desired.

Fig. 3 shows a further embodiment of the invention, in which the glass tube or cup 6 sealed to the wire 5 carrying catwhisker point-contact element 4 is made longer, extending beyond the crystal 1, which is now soldered or otherwise affixed to a metal pin 12 which has a threaded or knurled portion 13 to facilitate handling. Pin 12 is fixed to the metal diaphragm 14, which in turn is fixed to a metal sleeve 15, for example by being set in a groove 16 as shown. Sleeve, fitting or bushing 15 has the outwardly extending flange 17, sealed to the glass tube 6 at the otherwise open end of the latter. The pin 12 is set into the diaphragm 14 until the tension in catwhisker 4 is about correct, and then the pin 12 and diaphragm 14 may be manipulated until a good contact point is found on the crystal. The metal end cap 18, with the pigtail connector wire 19 affixed thereto, is attached to the metal sleeve 15, for example by solder 20.

Various departures or modifications may be made in the described embodiments without departing from the spirit of the invention. For example, more than one catwhisker contact and corresponding connecting wire may be used, if the device is intended to be employed as an amplifier. Two catwhiskers may be used side by side, if desired, as in copending application Serial No. 40,561 of S. Amico, or concentrically as in copending application Serial No. 39,665 of F. Koury.

The word glass is used in a broad sense, including fused quartz, for example. With a particular glass, the proper metals or alloys should be used to effect a seal with that glass.

What I claim is:

1. A semi-conductor translator having a point-contact element, a semi-conductor element engaged by said point-contact element, an envelope enclosing said elements, said envelope including a glass wall portion and a metal end cap, a cylindrical metal fitting sealed to said glass wall portion, and a support extending adjustably through said fitting and carrying one of said elements within the envelope and having an engageable portion, said cap being soldered to said fitting and covering the engageable portion of said adjustable support.

2. A semi-conductor translator including an envelope having a glass wall portion and a metal end cap, a pair of translator elements in mutual

contact contained within said envelope, one of said elements being a piece of semi-conductive material, a bushing sealed to said envelope having a female threaded portion within the envelope, a male threaded element adjustably secured therein and supporting said semi-conductive material inside the envelope, said metal end cap being joined to said bushing to cover said male threaded element.

PAUL E. GATES.

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