

March 31, 1925.

1,532,002

E. THOMSON

COMPOSITE QUARTZ BODY

Filed Oct. 30, 1922

Fig. 1.

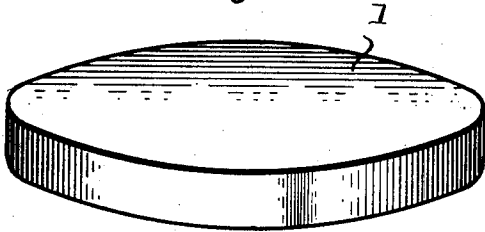


Fig. 4.

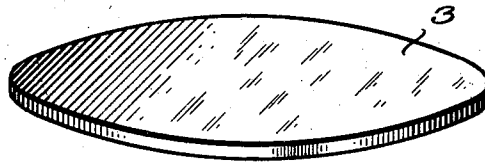


Fig. 2.

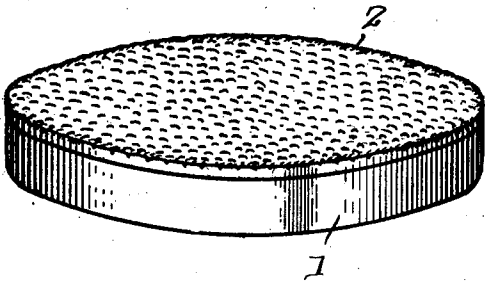


Fig. 5.

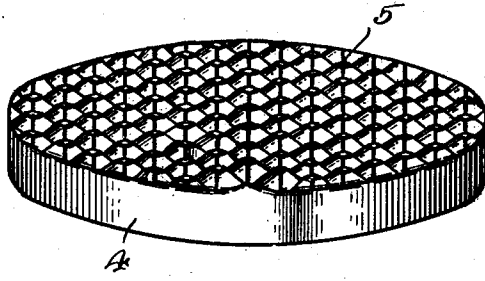


Fig. 3.

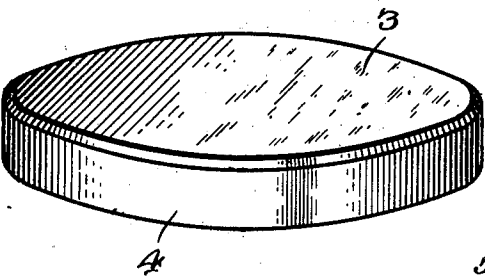


Fig. 6.

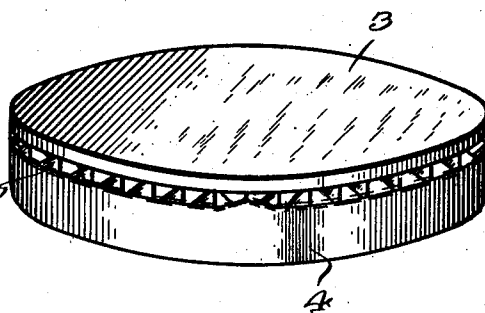
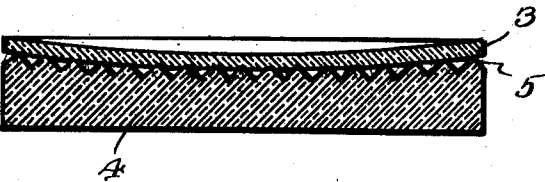


Fig. 7.



Inventor,  
Elihu Thomson,  
by Alexander S. Lunt,  
His Attorney.

Patented Mar. 31, 1925.

1,532,002

# UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF SWAMPSCOTT, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## COMPOSITE QUARTZ BODY.

Application filed October 30, 1922. Serial No. 597,964.

*To all whom it may concern:*

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing at Swampscott, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Composite Quartz Bodies, of which the following is a specification.

The present invention relates to the production of articles of quartz which are particularly adapted to the production of reflectors for scientific instruments, as for example, telescopes in which a light-reflecting surface of constant and accurate focus is desired.

A great deal of trouble has been experienced in accurate scientific work, particularly in astronomical observations because of the expansion and contraction of reflectors due to changes of temperature. It is necessary to keep reflectors for large telescopes in storage rooms in which an even temperature is carefully maintained and even when the temperature of the reflector has been allowed to become equalized before taking observations some blurring of the image occurs due to unavoidable thermal changes in the mirror. The problem of preserving a true reflecting surface becomes especially great when observations of the sun are made due to the heat imparted to the mirror during the observation.

The difficulty of working fused quartz has made it impracticable to secure a plate of clear, homogeneous quartz of sufficient size and thickness to serve as a reflector for telescopes. When a quantity of crude quartz, as sand or crystals, is heated in a mold to fusion, the product is an opaque mass which is filled with innumerable minute cavities or bubbles something like snow when converted into solid ice after partial fusion. Such a mass also is apt to have an irregular surface and may contain large cavities.

This opaque quartz may be rendered clear but the process is expensive and the resulting product is not easily obtained in large masses.

In accordance with my invention, I have provided a reflector of amorphous silica or quartz glass which consists of a plate of high grade, clear quartz backed by a plate of the more easily formed opaque quartz.

The accompanying drawings illustrate several embodiments of my invention. Figs.

1 to 3 show successive stages of manufacture of a mirror beginning with a base of crude opaque quartz (Fig. 1) faced with high grade clear quartz (Fig. 2) the finished product being ground, polished and silvered (Fig. 3); Figs. 4 to 6 illustrate the successive steps in the manufacture of a modification in which the base plate of crude quartz is provided with facets to facilitate fusion of the heavy base plate to the thinner face plate and Fig. 7 illustrates in section a modification in which the junction of back plate and face plate is made on a curved surface.

Referring to the drawing, the quartz mirror preferably is made by first preparing a slab 1 of quartz by the fusion in a suitable mold of arenaceous quartz, that is, a good grade of quartz sand. For example, coarse quartz sand may be heated in a carbon mold to the fusing temperature, about 1760° C., in an electrically heated furnace. At this temperature the quartz is rendered soft enough to coalesce. The heavy plate of quartz thus prepared is then fused with the thinner layer 2 of high grade transparent quartz by the fusion of many small pieces of clear quartz arranged together upon the upper face of the thicker quartz plate. Preferably the plate 1 and the facing layer 2 of high grade quartz are heated together in a suitable furnace. The fusion of clear pieces of quartz on the backing plate causes the pieces to spread out and coalesce. The surface of the article thus prepared is ground as indicated in Fig. 3 and then is silvered or otherwise coated with a reflecting layer.

In some cases a plate of transparent quartz is prepared by rolling or pressing pure silica in a plastic state into sheet form. This plate then is attached to a backing plate of ordinary opaque quartz. As shown in Figs. 4 to 6, a plate 3, of high grade quartz glass which is free from cavities or bubbles is attached to a thicker backing plate 4 which has been provided with protuberances or facets 5 by grinding or molding. When the plates 3 and 4 are heated to the softening point in a suitable furnace, a mold usually being unnecessary, the tips of the protuberances which are illustrated as square pyramids, attach themselves to the plate 3 before the plates 3 and 4 have become so plastic as to become deformed ap-

preciably. If desired the plate 4 may be ground to provide the facets 5 upon a curved surface, as shown in Fig. 7. The plate 3 which may also be ground to roughly fit the facets 5 is then attached by incipient fusion as already described. The surface of the plate 3 finally is accurately ground, polished and provided with a reflecting surface layer.

10 What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. An article of manufacture comprising a plate of transparent quartz glass having a surface of regular configuration, and a backing plate of opaque quartz glass.

2. An article of manufacture comprising a plate of homogeneous quartz glass free from cavities, a backing plate therefor of crude quartz glass, said plates being united by protuberances on one of said plates.

3. The method of making a plate of

quartz which consists in heating a plate of substantially clear homogeneous quartz in contact with a backing plate of opaque quartz until adhesion occurs.

4. The method of making a plate of quartz having a regular, unbroken surface which consists in heating quartz sand in a mold to cause coalescence of the particles, thereby forming an opaque mass, and then facing said mass by local fusion with a layer of clear, homogeneous quartz.

5. The method of constructing a composite article of quartz which consists in providing a main body of quartz with protuberances and uniting said body with another body of quartz by fusion of said protuberances while leaving said main body otherwise intact.

In witness whereof, I have hereunto set my hand this 27th day of October, 1922.

ELIHU THOMSON.