

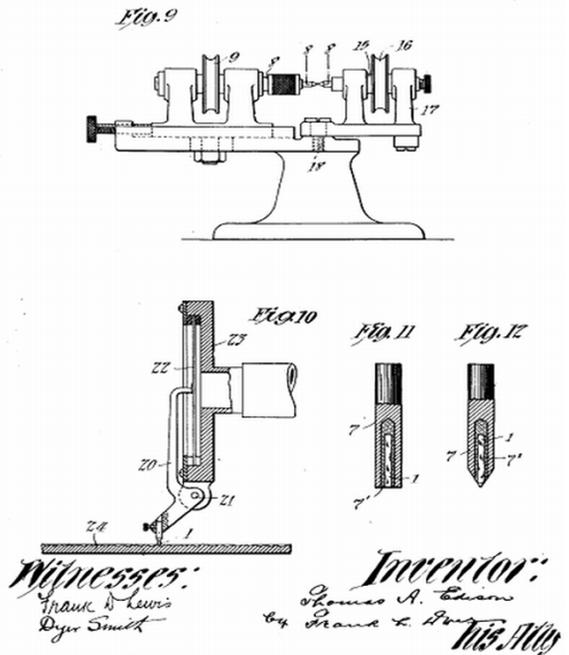
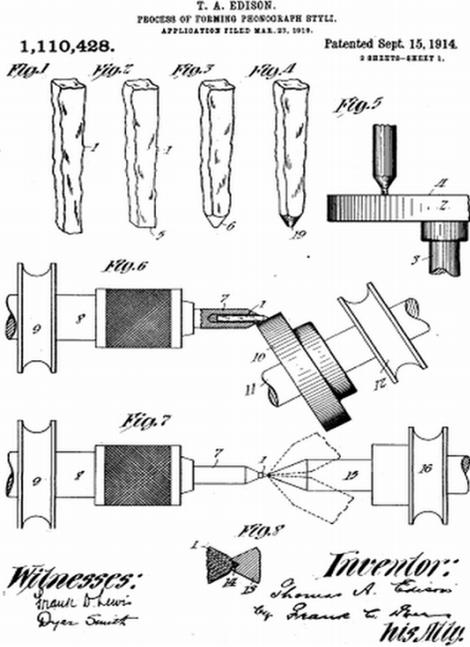
**Bonded tip (diamond tip inserted/bonded to metal shank) has a longer history than block diamond (both tip and shank are made of one block diamond).**  
 Here I compiled some patents as under.

Process of forming phonograph styli (Diamond Stylus Tip).

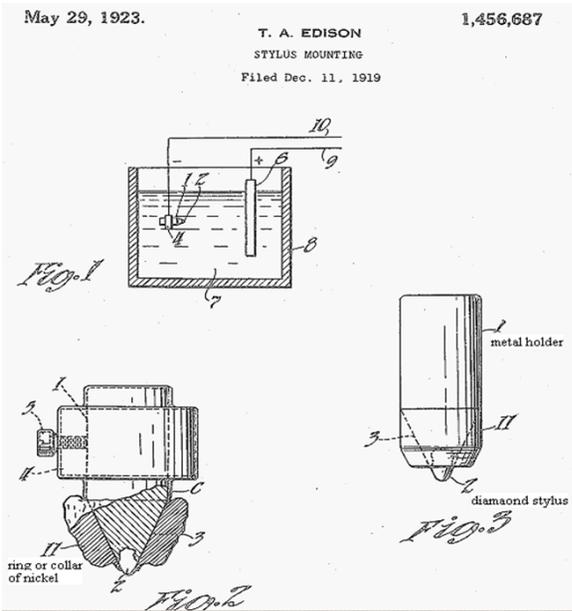
Hard record material such as Phenolic resin was experimented by Aylsworth so that there was a need for making hard stylus tip.

Diamond stylus used on Edison Diamond discs which were made of Phenolic resin.

- Fig.1-~Fig.4 diamond splint
- Fig.5 lapping the end of the splint to a flat surface
- Fig.6 the method of holding the stylus and lapping or grinding a taper upon the end thereof.
- Fig.7 & Fig.9 apparatus for performing a final step of process
- Fig.8 enlarged partial view of Fig.9 (rounding the bottom of tip suitable for contacting the bottom of groove)
- Fig.10 reproducer (sound-box) though this is different from embodied model.
- Fig.11
- Fig.12



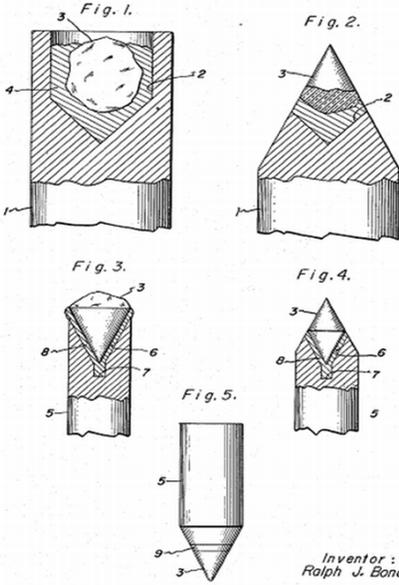
Edison showed alternative method of mounting a diamond tip to shank. Collar of nickel prevents the small tip from dropping from shank.



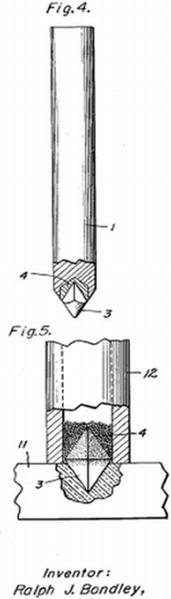
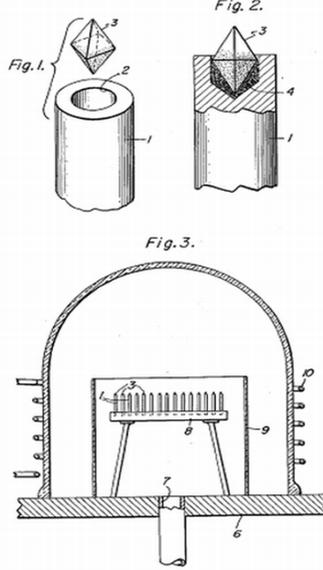
**Bondley from GE invented modern method.**

Special shape of shank base suitable for bonding diamond tips.

Titanium shank for bonding a diamond tip with solder bond of granulated nickel etc.



Inventor: Ralph J. Bondley,



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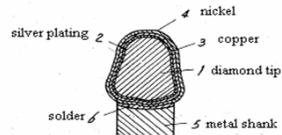
These methods (**bonding titanium shank and diamond tip in the vacuum furnace**) are widely adopted by many manufacturers, but the soldering alloys and shank can be various in composition. Not only a conical (spherical) bond tip, but also an elliptical bond tip can be made in similar way. A Japanese example by OGURA JEWEL INDUSTRY CO. Japanese Patent Announcement S37-18973 (Year code S37=1962) This method can omit the drilling process in the shank and any diamond tip bigger than the diameter of shank can be used. As a result the shank diameter can be reduced.

(2) 特公 昭 37-18973

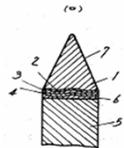
第 1 圖



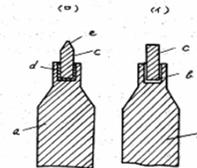
第 3 圖



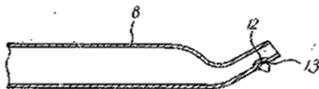
第 2 圖



第 4 圖  
Prior Art



Later Ogura developed a method of soldering a conic tip directly to cantilever. [JP 1064931] Shankless conic tip is made by above method separating the cone from shank and only the finished cone is soldered to cantilever.



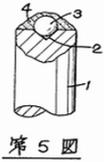
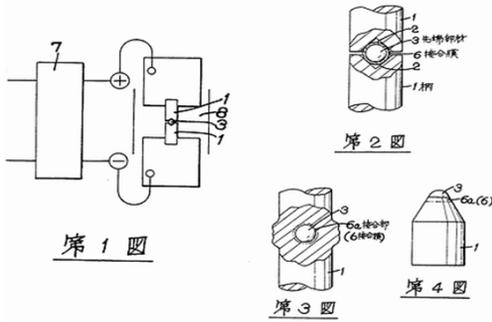
Though Ogura tried to market this stylus with trademark "PATEMAX" around early 1970s, I have never seen actual product.

**HOWEVER BONDED TIPS ARE STILL APT TO DROP WITH ROUGH HANDLING.**

Once Nagaoka invented another method of bonding tip without using the soldering alloy Japanese Patent application S62-38501 (never patented) "Playback needle and its manufacturing method" "silver and copper contained in solder corrode electro-chemically easily. In general environmental test spraying salt will reduce bonding strength. Hence Anti-corrosion coating and surface treatment have been applied to prevent this." "This patent application presents a method of bonding titanium or titanium alloy shank and diamond tip with ion sputtering of titan to and spot welding method. It does not degrade the strength of joints." I don't know whether this has succeeded actually or not.

- 1) coating tip 3 with sputtering 5 micron titan film 6
- 2) bonding tip and shank in an inert gas sandwiching two titan shanks as electrodes

Fig.5 & Fig.6 show conventional method using soldering alloy.



- 4 -

IMO: Another demerit of bonded stylus is the quality of diamond itself. Diamond crystal strength depends on the direction of cut. In case of bonded stylus tip, the direction of crystal is often obliterated or ignored. Of course there is variance of quality in block diamonds too.

Usually the cross section of a block diamond is square or rectangle. In processing the end of shank to a specific tip, metal holder is used.

The following is an example proposed by Ogura Jewel Industry Co. about BLOCK DIAMOND WITH ELLIPTIC STYLUS

Japanese Utility Patent Publication S52-84803 (year code S52=1977)

Japanese Utility Patent Announcement S53-168

Patented as 1247968

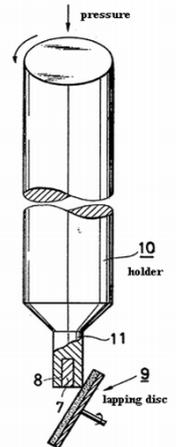
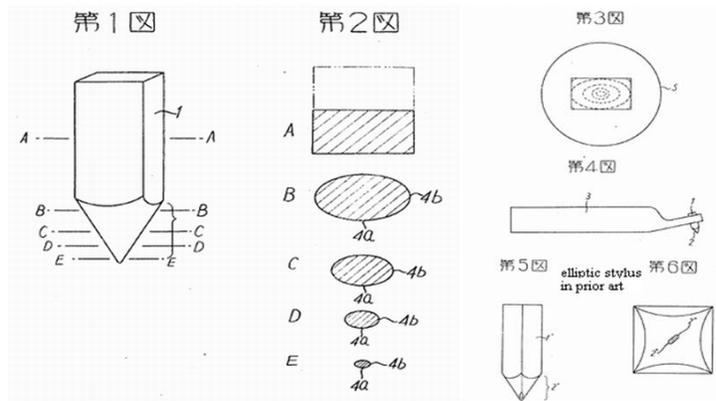
Main point of claim: use of rectangular block instead of conventional square block

Merits described in announcement:

- 1) reduction of material (cost & mass)
- 2) easy mounting a stylus on cantilever without using loupe because of rectangular shape
- 3) true elliptic shape in comparison with conventional quasi-elliptic stylus

Commenting that conventional elliptic stylus was made from square block diamond and production process was step 1 cone / step 2 flattening two facets along a diagonal line to shank / step 3 rounding small radius of two points along another diagonal line. Hence the cross section of tip was quasi-elliptic shape consisting of two lines and two rounds.

The rectangular block diamond can be processed more easily and more correctly to true elliptic shape.



The following drawing is from expanded patent application to Germany DE2657623 by Ogura. This structure corresponds to the holder 5 in above Fig.3.