CHARLES STARK DRAPER PRIZE

CANDIDATE(S) NAMES(S):
(Include all candidates' names for joint nominations)

SUMMARY OF ACCOMPLISHMENTS:

Up to 1954, all approaches to diamond making had failed as no equipment could provide the required pressure and temperature despite the considerable effort of some of the best scientists like Percy Bridgman (*), whether personally or as head of a team comprising research staffs from General Electric, Norton and Carborundum (during the war years). In 1947, Norton resumed the project of making diamond. This company had enjoyed tremendous success creating high pressure minerals, but diamond making clearly needed something more. General Electric decided to start again and a team of 5 research scientists was completed in 1951, including H. Tracy Hall.

They of course started with the equipment Percy Bridgman had invented. Yet, his simple opposed anvils device had to be seriously modified in order to allow heating the sample while keeping the anvils cool enough, which the original device could not do. Several G.E. scientists developed their own equipment, including Tracy, who called his the "Belt", now famous. Yet, although this brilliant invention was giving the pressure and temperature considered more than needed to make diamond, no direct conversion of graphite could be obtained. For over one year, Tracy tested in his Belt different types of carbon or carbon containing compounds as well as many different possible "catalysts".

After several hundreds runs, Tracy finally succeeded to make the first diamond ever in conditions that others - given the proper indications - could reproduce. This clause was essential as too many errors (or, in a few cases, even fraud) had been committed in the past, especially when a natural diamond seed was used.

Tracy Hall left G.E. a few months later for Brigham Young University, Provo, Utah where he started a brand new high pressure laboratory. In the meantime, he was told that he was not allowed to use the Belt he had invented at G.E. because it had been given proprietary order by G.E. and a secrecy order by the Government, as diamond was considered a strategic material. He had no choice : he had to invent a completely different equipment which, for sure, would not fall within the realm of the patents already taken.

This was a real challenge.

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SUMMARY OF ACCOMPLISHMENTS (continued –page 2):

When he was working in the famous G.E. laboratory of Schenectady, some doubt was possible as to what Tracy had personally invented and what was due to the entire team. All doubt was lifted when, before the fifties were over, Tracy invented and built a brand new type of design, completely different from everything that had been made before : the tetrahedral and cubic presses. These presses - as well as the Belt - were brilliant inventions which were patented.

An other important feature of the belt, tetrahedral and cubic presses is their useful volumes, much larger than that of previous devices, which is very important for their industrial use and, indeed, industrial production of synthetic diamond could start pretty soon after.

These equipments, dating back 40 or 45 years are still the best ones ever invented as they are used the world over - in different schemes - in the manufacturing of synthetic diamond and cubic boron nitride grits as well as polycrystalline diamond and CBN pieces.

Grits and polycrystalline pieces are used in a wide variety of industries and materials like mechanical workshops, oil drilling, mining, glass, stones like granite and marble, ceramics etc - where they do a better job than any other tooling : tolerances and finish are better, cost is lower, diamond wheels and saws make no dust, less noise etc. In critical operations like aircraft, space, armement and even automotive industries, there is no alternative.

The world consumption of diamond and cubic boron nitride grits is around one billion carats (200 m tons) today, of which only 40 million, or 4 % is of natural origin, as the mines cannot supply more. Important industrial sectors would be crippled without synthetic products.

Last but not least, I would like to emphasize the enthousiasm that spread through the U.S. laboratories when it was known that man had finally found the way to make diamond. Scientists learned how to use the new technology and started searching for new materials not existing in nature (like cubic boron nitride, second hardest material after diamond, used to turn or grind hard steel) or study the properties of matter under pressure etc.

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SUMMARY OF ACCOMPLISHMENTS (continued –page 3):

I worked with Tracy for 6 months in his BYU laboratory and, in my view, you can hardly find a better candidate for your prestigious prize.

(*) P.W. Bridgman's citation in 1946, when he was awarded the Nobel prize in physics states : "... for the invention of an apparatus to produce extremely high pressures and for the discoveries he made therewith in the field of high pressure physics".

NOMINATOR'S SIGNATURE

February 8, 1999.

DATE