WHY SHOULD SCIENTISTS IN ACADEMIA PATENT? : SOME PERSONAL REFLECTIONS

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SCIENTISTS AS AN INVENTOR

- **Patenting defines a scientist as an inventor**
- **As a currency or visiting card, patents add credibility to scientist as an inventor**
- **Patenting provides an inventor opportunities to translate science into useful products or processes**
- **Patenting has created incredible wealth to scientists – notable inventors in academia (C. Djerrasi, Bruce Merrifield, Boyer, G.W. Whitesides, Langer, H.C.Brown , J.P.Kennedy)**
- **The quantity and quality of patents define the "Innovation quotent" of an individual, organization or even a nation**

OBJECTIVE OF A PATENT

- **Provide incentive to inventor to disclose his/her findings for the long term benefit of society rather than an attempt to profit from the invention in secret**
- **A patent is a legal covenant between the "state" and the "inventor"**
- **The patent gives the owner only a "right to exclude others from practicing the invention", not a right to "practice the invention". Freedom to practice is not implied in grant of a patent**
- **The framing of US Patent Laws in 1870 was a landmark event, providing extraordinary stimuli to science and technology and heralding the "industrial revolution" and the epoch making discoveries of the twentieth century**

EARLY PATENT SYSTEMS

- First patent (20 year) granted to Galileo by the Doge of Venice on a “Lift irrigation mechanism for raising water to fields”
- Enshrined in the U.S. Constitution, Article 1, Section 8 (July 4, 1776) and converted to an Act of US Congress in 1790
- The first US Patent, July 31, 1790 to Samuel Hopkins on an “Improved method for making potash from wood ashes for use in soad making”, signed by George Washington, Edmund Randolph and Thomas Jefferson

WHY WERE PATENTS CREATED?

- Patents are an instrument to project intellectual property
- Origin of patents shares an interesting history with the origins of chemistry
- The early Alchemists were driven by a desire to convert base metals to gold! However, everyone kept their “knowledge” secret
- Isaac Newton was the most prolific Alchemist; His prodigous efforts (never successful) made him experiment with chemical substances and conversions. However, almost all his laboratory records were never made public or published

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WHY WERE PATENTS CREATED?

- However, Isaac Newton kept meticulous notes in his own handwriting. Much of this were made public several years after his death, exposing the ingenuity of Newton
- Efforts of Alchemists were always held confidential. So while Physics and Mathematics progressed, chemistry was perceived as a mysterious, secretive science till Michael Faraday dispelled this notion

Lesson : Undue secrecy and confidentiality hinders the progress of science. Public disclosure serves the cause of progress of science

HISTORY OF INDIAN PATENT REGULATIONS
(SOURCE : PATENT OFFICE, GOVERNMENT OF INDIA)

Year	History of Indian Patent Regulations
1856	The Act VI of 1856 protecting inventions. Framework used the British Patent Law of 1852
1859	Modified Act XV
1872	The Patents and Designs Protection Act
1883	The Protection of Inventions Act
1888	The Inventions and Design Act
1911	The Indian Patents and Design Act
1972	The Patents Act (Act 39 of 1970)
1972	The Patent Rules of 1972
1999	The Patents (Amendment) Act of 1999
2002	The Patents (Amendment) Act of 2002

INDIAN PATENT LAWS AND ITS IMPACT ON GROWTH OF PHARMA INDUSTRY

Indian Patent Act 1911	**Modeled after US and UK Patent Laws; Indian Patent Office established**
Indian Patent Act 1970	**Abolished "product" patents in health and food sector. Process patents valid for seven years. Legal right and freedom to manufacture and market within India any drug available internationally ; Domestic pharma industry flourishes through "reverse engineering"**
Indian Patent Act 2005	**India harmonizes its laws with that of the world; WTO- TRIPS compliant; Domestic drug industry ramps up discovery research and "non-infringing" routes to generics**

INVENTION AND INNOVATION

- **An Invention is an idea that can solve a practical problem in a new way, while innovation is the action needed to put it into practice**
- **The greater the scientific knowledge of the inventor, the greater is his or her range of potential inventions**
- **Innovation may take place centuries after the invention because the knowledge was not in the right place, the materials and processes were lacking or because there was no big reward**
- **Predicting the future of invention/innovation is important, bit it is rarely correct**

PATENTS AS TOOLS FOR INNOVATION MANAGEMENT

- Create wealth out of intellectual property
- Create value to customer
  - Create patent estates
- Provide secure technology transfer
  - Minimize probability of infringement
  - Open global markets
- Competitive assessment

S.S. BHATNAGAR, FRS : SETTING THE EXAMPLE

- One of the doyens of Indian science and technology and founder of CSIR
- Recognized for his fundamental scientific contributions to the physical chemistry of emulsions, colloid chemistry and magnetochemistry (1924-1940)
- Elected Fellow of the Royal Society at the age of 49 (1943)
- An inventor extraordinary
  - •Built a magnetic balance which was marketed by M/s. Adam Hilger & Co., London (1928)
  - •Congealing of drilling mud by saline water – a problem faced by M/s. Steel Brothers & Co., London. Bhatnagar understood this as the flocculating action on colloids by electrolytes and solved the problem by addition of an Indian gum

Contd…

Contd…

S.S. BHATNAGAR, FRS : SETTING THE EXAMPLE

- Pleased with the solution, M/s. Steel Brothers made an endowment of Rs. 1,50,000/- to Dr. Bhatnagar, to set up a Department of Petroleum Research at the Punjab University, Lahore
- The department undertook research on increasing flame height of kerosene, de-odorization of waxes and utilization of byproducts from mineral oil industry
- The first collaborative research with industry for a period of ten years!
- Bhatnagar refused personal monetary benefit

Lesson : There is no disconnect between excellence in science and application of science. They are, but, two sides of the same coin

Lesson : Innovative solutions to practical problems requires deep understanding of the underlying science.

S.S. BHATNAGAR, FRS :
THE FIRST INVENTOR IN CSIR

PATENT SPECIFICATION

Application Date: Aug. 17, 1935. No. 22257/35. 461,518

Complete Specification Left: May 18, 1936.

Complete Specification Accepted: Feb. 19, 1937.

PROVISIONAL SPECIFICATION

Improvements relating to the Refining of Mineral Oils

We, STEEL BROTHERS & COMPANY LIMITED, a British Company, of 8, Fenchurch Avenue, London, E.C.3, and SHANTI SWARUP BHATNAGAR, a British Subject, of Universities Chemical Laboratory, Lahore, India, do hereby declare the nature of this invention to be as follows:—

Crude petroleum is separated by distillation into various fractions such as petrol, kerosene, gas oil, lubricating oils, etc., some of which require a refining treatment in order to render them suitable for use.

In the case, for instance, of the kerosene fraction, which usually distils between the approximate limits of 150° C. and 300° C. such a treatment is generally required for improving the burning qualities of the oil with respect to tendency to smoke and incrustation of the wick, and for reducing the tendency to discoloration during storage. The known treatment with strong or fuming sulphuric acid as with reagents is not satisfactory in the case of kerosene of inferior quality, containing a relatively high percentage of aromatic and unsaturated hydrocarbons, and such kerosenes are usually refined by treatment with certain selective solvents which extract the undesirable constituents of the oil; such solvents are, for instance, liquid sulphur dioxide, phenol, alcohol and nitrobenzene, of which only the first-named has found extensive commercial application.

The lubricating oil fraction (which may be a distillate or may constitute the distillation residue according to its grade and to the nature of the crude petroleum) is in some cases treated with a selective solvent in order to improve its viscosity index and resistance to oxidation and to reduce its tendency towards the formation of carbon deposits. As such solvents, furfurol, nitrobenzene, benzene and sulphur dioxide, liquid propane and cresylic acid have been proposed among others.

According to this invention mineral oils are refined by treatment with glacial acetic acid. It has been found that this acid has a good selective solvent action on the undesirable constituents of the oils; furthermore, it is easily recovered unchanged and its use does not necessitate operation under pressure or at low temperatures. In the case of some oils it may be advantageous to dilute the oil under treatment with lighter hydrocarbons to reduce its viscosity and subsequently recover the diluent by distillation, or alternatively to carry out the process under temperatures or pressures other than atmospheric.

The invention is useful in its application to any petroleum fractions, in particular, burning oils and lubricating oils. From a low grade kerosene it is possible to obtain a refined product approximately equivalent to that obtainable with use of liquid sulphur dioxide, but in better yield. Crude lubricating oils are substantially improved in their viscosity index, their resistance to oxidation and their colour and may only require a final treatment with clay or the like in order to give products of high quality.

In carrying out the invention, the oil is intimately mixed with a suitable quantity of glacial acetic acid (say from two to five times its volume depending on the nature of the oil and the degree of refining desired) and the mixture is then allowed to separate into layers. The upper layer, consisting of refined oil containing some dissolved acetic acid, is removed and may be freed from acid by (a) washing with water; or (b), by first treating it with solid sodium acetate, removing the acid layer which separates and then washing the oil with water; or (c) by first cooling, removing any acid layer which separates at the lower temperature and then proceeding according to (a) or (b) above; or (d) by distillation. The acetic acid extract constituting the lower layer may be similarly freed from acid after removal of the bulk of the acid by distillation under ordinary or reduced pressure.

The acetic acid recovered, together with that recovered from the water washings by suitable methods may be used again in the process. Alternatively the acid diluted in the washings may be used for other purposes, for example, for

[Price 1/-]

Price 4s 6d

PATENT SPECIFICATION 502,762

Application Date: April 4, 1938. No. 9346/38.

Complete Specification Accepted: Sept. 19, 1939.

COMPLETE SPECIFICATION

Improvements in or relating to the Manufacture of Containers, Receptacles, Hollow-Ware or the like from Resin-Impregnated Laminations

We, SIR SHANTI SWARUP BHATNAGAR, O.B.E., D.Sc., F.R.S., F.Inst.P., F.I.C., ARDIT RAHIM KHAN, B.Sc., and LALCHAND VERMANI, M.Sc., Ph.D., F.Inst.P., A.I.I.Sc., all of the Council of Scientific and Industrial Research, University Buildings, Delhi, India, all British Indian subjects, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an improved method for the production of containers, receptacles, moulds, hollow-ware or the like from resin-impregnated laminations.

A number of methods have been developed in the past few years for the production of containers, receptacles, utensils and the like from resin-impregnated laminations.

According to one such method, impregnated laminations with improved margins are cut into the shape of rounders, and the joints formed by the impressed margins are then compressed under heat and pressure. In actual practice, it has been observed that this method involves a great deal of time and labour in order to get the desired results. In another method of producing hollow articles, cups or cup-like discs of fibrous sheet material, such as cotton duck or paper impregnated with a plastic composition such as a phenolic resin in an incompletely reacted state are placed in a recess provided in the upper surface of a hollow moulding die, the said discs being of a diameter sufficient to produce the bottom and side walls of the hollow article, the said discs being then forced down into the cavity of the moulding die by means of a plunger die, thereby carrying up the edges of the discs and forcing them between the sides of the plunger die and the cavity, the downward movement of the plunger die being continued until the requisite pressure has been applied to produce the finished article, the disc being heated to the customary moulding temperatures.

The present invention consists in a method of making containers, receptacles, utensils, hollow-ware or the like from laminations comprising fibrous sheet material impregnated with resin, by employing the laminations upon the periphery of a hollow mould part or matrix and pressing them by means of a co-operating mould part or die member so as to force the laminations into the hollow mould part and against the sides and bottom thereof, but instead of allowing the laminations to expand freely at their edges, as in the case of the second method above referred to, the co-operating mould part is provided with a shoulder having a width equal to the thickness of the edge of the finished article, against which the edges of the laminations abut during the final stages of the moulding operation and are pressed into a dense and rigid shape.

The invention is illustrated in the accompanying drawings, in which the steps involved in the process of pressing are depicted in four stages.

Figure 1 represents the first stage, in which the mould is just beginning to close;

In Figure 2, the laminations are shown in the initial stage of taking the shape of the mould;

Figure 3 illustrates the point at which the sheet C is about about prior to pressure being applied; and Figure 4 shows the moulds in the fully closed stage, under pressure, in which the laminations have taken their appropriate shape.

Figures 5 to 9 show the various stages during the making of the mould for making an ash tray, and

Figure 10 is an illustration of the final moulded article.

A more detailed description of the process according to the invention will be now given.

Impregnated sheet laminations may be made out of the diverse forms of cotton cloth, jute cloth, paper or any similar fibrous sheet material. For example, jute may be used in the form of hessian, sacking or canvas. The fibrous material is impreg-

[Price 1/-]

Price 4s 6d

EARLY LESSONS IN PATENTS : UNIVERSITY OF AKRON (1972-73)

- A course (1 semester) on "Patenting for chemists" by Professor J.P. Kennedy (JPK)
- Professor Kennedy came to academia after a distinguished industrial career of over 20 years at Exxon Research and Engineering
- JPK (80 years) obtained his 100th US Patent in 2009

Lesson : Excellence in science and applications are not mutually exclusive

Mere exploration without exploitation of knowledge is sterile. In an environment where research is predominantly publicly funded, this situation leads to loss of credibility amongst stakeholders

THE POWER OF A COMPELLING VISION

- **Dr. R.A. Mashelkar, Director, NCL articulates a vision – "patent, publish and flourish" (1990)**
- **NCL takes the lead, US Patent 5, 266, 659 filed 5 May 1992, granted 30 November 1993**
- **Dr. Mashelkar, takes this initiative across CSIR as a DG, CSIR (1995-2000), making CSIR a leading generator of IP amongst institutions / industries in India**

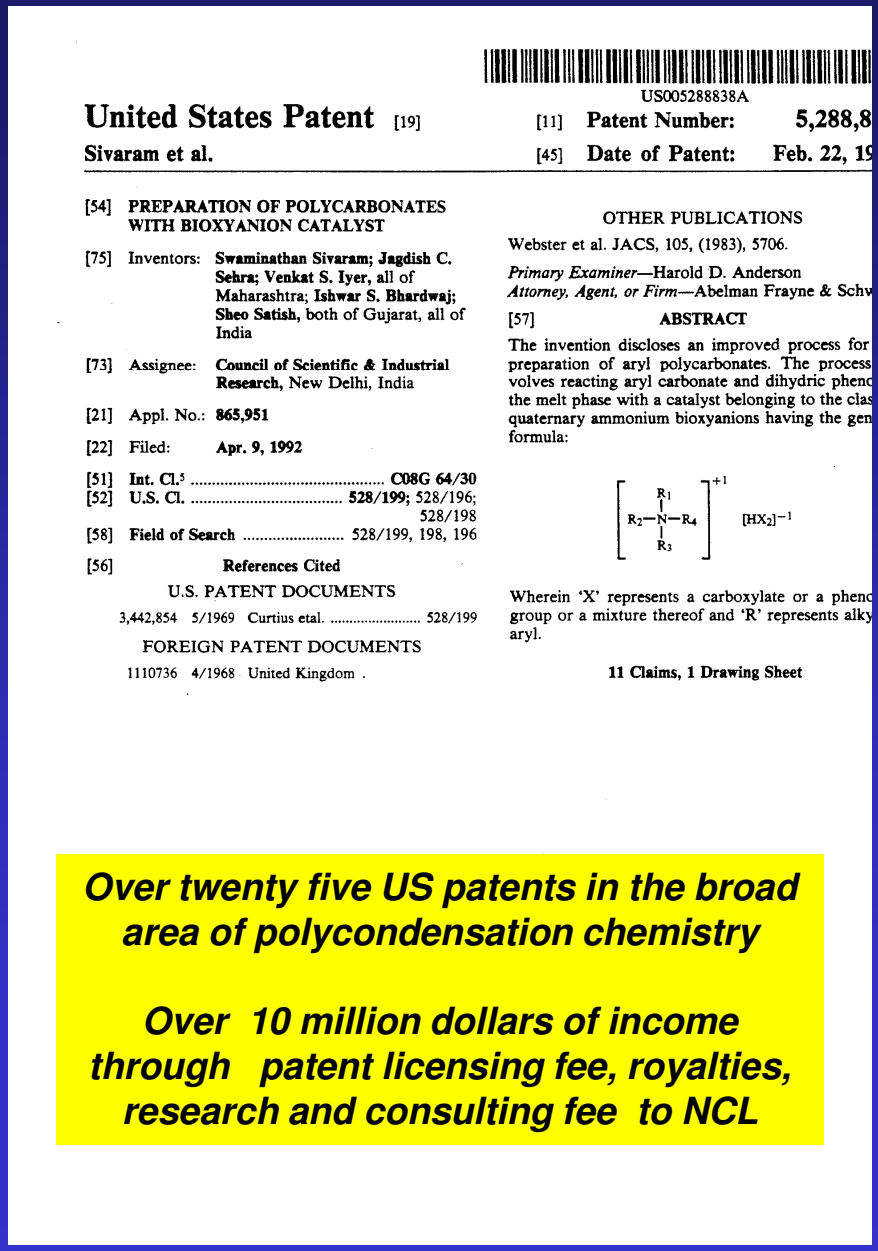
Lesson : Articulating a vision is the true mark of a leader; vision works magic

EARLY YEARS AT NCL : THRILL OF PATENTING (1989-1994)

- To obtain a US Patent was an event of life time
- Celebrated by the laboratory, a new respectability amongst peers
- Freedom decide whether patent or not; no structured processes, no one to ask questions! No one to stand in judgement!
- Read all prior art patents; wrote every line and struggled with framing the claims; argued with the patent examiner – each one a new experience
- To invent was considered worthwhile

Lesson : You learn best when there are no teachers or structures

EARLY YEARS AT NCL : THE THRILL OF PATENTING



US005288838A

United States Patent [19]

Sivaram et al.

[11] **Patent Number: 5,288,8**

[45] **Date of Patent: Feb. 22, 19**

[54] **PREPARATION OF POLYCARBONATES WITH BIOXYANION CATALYST**

[75] Inventors: **Swaminathan Sivaram; Jagdish C. Sehra; Venkat S. Iyer,** all of Maharashtra; **Ishwar S. Bhardwaj; Sheo Satish,** both of Gujarat, all of India

[73] Assignee: **Council of Scientific & Industrial Research,** New Delhi, India

[21] Appl. No.: **865,951**

[22] Filed: **Apr. 9, 1992**

[51] **Int. Cl.**[5] **C08G 64/30**

[52] **U.S. Cl.** **528/199**; 528/196; 528/198

[58] **Field of Search** 528/199, 198, 196

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,442,854 5/1969 Curtius etal. 528/199

FOREIGN PATENT DOCUMENTS

1110736 4/1968 United Kingdom .

OTHER PUBLICATIONS

Webster et al. JACS, 105, (1983), 5706.

Primary Examiner—Harold D. Anderson

Attorney, Agent, or Firm—Abelman Frayne & Schv

[57] **ABSTRACT**

The invention discloses an improved process for preparation of aryl polycarbonates. The process volves reacting aryl carbonate and dihydric phenc the melt phase with a catalyst belonging to the clas quaternary ammonium bioxyanions having the gen formula:

Wherein 'X' represents a carboxylate or a phenc group or a mixture thereof and 'R' represents alky aryl.

11 Claims, 1 Drawing Sheet

Over twenty five US patents in the broad area of polycondensation chemistry

Over 10 million dollars of income through patent licensing fee, royalties, research and consulting fee to NCL

The Beginning

This patent led to over ten years of very productive and exciting research in the area of polycarbonates, resulting in several PhD thesis, publications and industrial partnership with GE plastics. This also established the principle of "organic catalysis" for polymer synthesis

EARLY YEARS AT NCL : THE THRILL OF PATENTING

US005266702A

United States Patent [19]

Bhaskaran et al.

[11] **Patent Number: 5,266,702**

[45] **Date of Patent: Nov. 30, 1993**

[54] **1,3-OXAZOLINE COMPOUNDS USEFUL AS ANIONIC INITIATORS SUITABLE FOR POLYMERIZATION OF VINYL POLYMERS**

[75] Inventors: **Durairaj Bhaskaran; Pradeep K. Dhal; Sanjay P. Kashikar; Ratnaprabha S. Khisti; Babanrao M. Shinde; Swaminathan Sivaram,** all of Maharashtra, India

[73] Assignee: **Council of Scientific & Industrial Research,** New Delhi, India

[21] Appl. No.: **585,683**

[22] Filed: **Sep. 19, 1990**

[51] **Int. Cl.**[5] **C07D 263/32**

[52] **U.S. Cl.** **548/235**; 546/145; 558/443; 560/105

[58] **Field of Search** 548/235

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,391,814	7/1983	Vorbruggen	548/239
4,574,157	3/1986	Homann	548/239

Primary Examiner—C. Warren Ivy
Assistant Examiner—James H. Turnipseed

Attorney, Agent, or Firm—Ladas & Parry

[57] **ABSTRACT**

Disclosed are reactive anionic initiators of the general formula $[ArCHR_1R_2N(R_3R_4R_5R_6]$ wherein Ar=phenyl, substituted phenyl, or a heterocyclic compound, $R_1=R_2=H$, ester, cyano, alkyl, aryl, 1,3-oxazoline, N,N-dimethyl amide and other similar alpha activating groups, or combination of them, or one of R_1 or R_2 together with Ar, where Ar is a phenyl or substituted phenyl, is a nitrogen atom containing heterocyclic compound and the other being a nitrile group, R_3, R_4, R_5 and R_6 may be same or different and represent substituted alkyl, cycloalkyl, arylalkyl or aryl or to of the R_3, R_4, R_5 and R_6 together with nitrogen atom form a heterocycle with the condition that the sum of all carbon atoms of all R_3, R_4, R_5 and R_6 is from 12 to 50 and no more than one of the R_3, R_4, R_5 and R_6 is an aryl derivative. The initiators which are in the form of solids or liquids are insoluble and can be incorporated which enable the synthesis of a wide range of polymers with functional groups. These initiators are useful for polymerizing very reactive vinyl monomers such as nit bearing vinyl compounds.

4 Claims, No Drawings

The first Composition of Matter Patent from NCL

toluene/methanol) was added. The reaction mixture was stirred for ½ hour at room temperature and the temperature was slowly raised to +50° C. and maintained for 3 hours at that temperature. Appearance of a deep red coloured solution in indicative of the carbanion formation. The reaction mixture was cooled to room temperature, the solvent was evaporated under vacuum and the product was dried at +40° C. under vacuum. The carbanion salt (tetra-n-butyl ammonium-N-benzoxy-2-cyano-dihydro isoquinoline obtained is a deep red coloured oily residue.

The main advantages of the present invention are:

a) The initiators can be prepared over a temperature range of +50° C. to +90° C.

b) The initiators which are in the form of solids or liquids are isolable and can be conveniently stored at ambient temperature. The initiators can also be prepared in two phase systems containing of an organic and an aqueous phase.

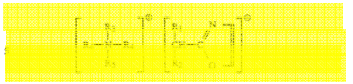
c) They are free from metal ions.

d) Several types of functional groups can be incorporated by using a range of readily available organic compounds as starting materials. These enable the synthesis of a wide range of polymers with functional groups.

e) It is possible to vary the reactivity of the initiators over a wide range by the appropriate choice of substituents in the starting material.

We claim:

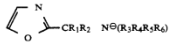
1. A reactive anion initiator of the formula



wherein R_1 is hydrogen and R_2 is selected from the group consisting of hydrogen, $COOC_2H_5$, cyano, alkyl, aryl or 1,3 oxazoline and R_3, R_4, R_5 and R_6 may be the same or different and are each hydrocarbyl of 3 to 16 carbon atoms, with the conditions that the sum of all carbon atoms of R_3, R_4, R_5 and R_6 is from 12 to 50 and that no more than one of R_3, R_4, R_5 and R_6 is an aryl derivative.

2. An initiator as claimed in claim 1 which is a carbanion salt: tetra-n-butyl ammonium 2-benzyl 1,3-oxazoline.

3. A reactive anion initiator of the formula



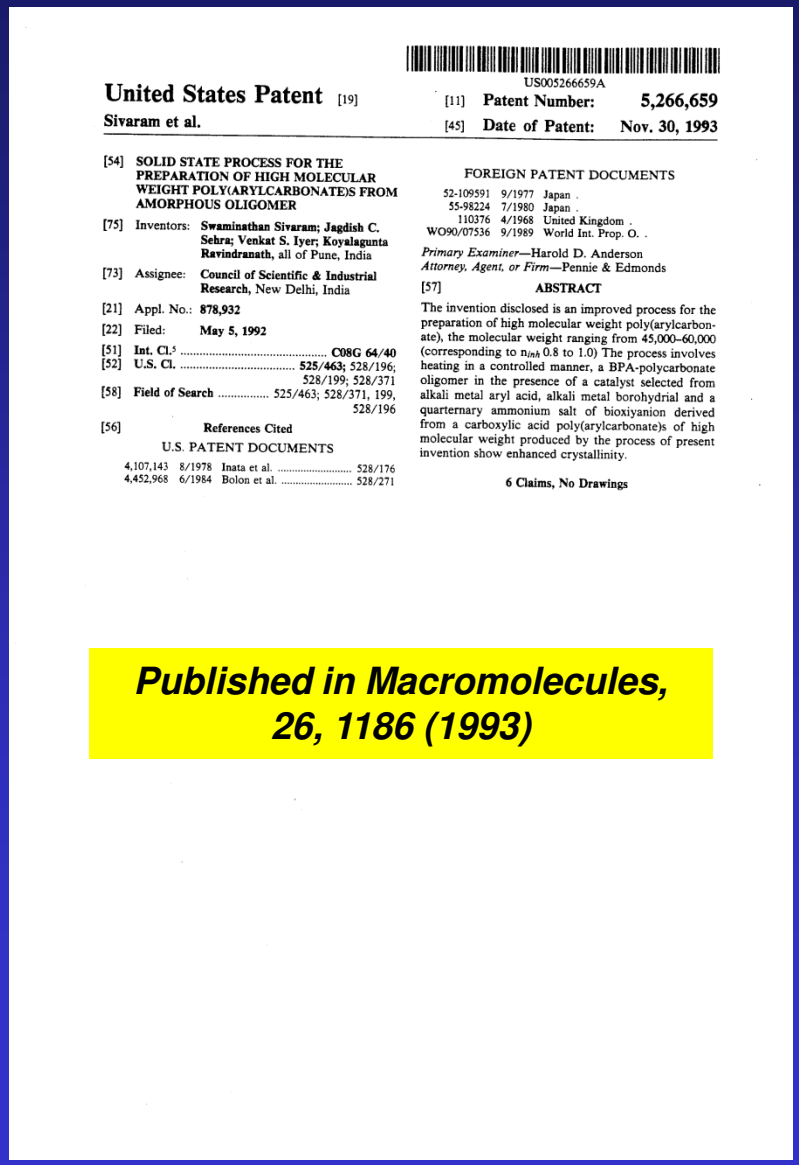
wherein R_1 is hydrogen and R_2 is hydrogen, aryl or a 1,3 oxazoline group and R_3, R_4, R_5 and R_6 may be the same or different and are each hydrocarbyl of 3 to 16 carbon atoms with the conditions that the sum of all carbon atoms of all R_3, R_4, R_5 and R_6 is from 12 to 50 and that no more than one of R_3, R_4, R_5 and R_6 is an aryl group.

4. An initiator as claimed in claim 3 which is a carbanion salt: tetra-n-butyl ammonium 2-methyl-1,3-oxazoline.

* * * * *

Macromolecules,24(6), 1697 (1991)

EARLY YEARS AT NCL : THE THRILL OF PATENTING



US005266659A

United States Patent [19]
Sivaram et al.

[11] **Patent Number: 5,266,659**
[45] **Date of Patent: Nov. 30, 1993**

[54] **SOLID STATE PROCESS FOR THE PREPARATION OF HIGH MOLECULAR WEIGHT POLY(ARYLCARBONATE)S FROM AMORPHOUS OLIGOMER**

[75] Inventors: **Swaminathan Sivaram; Jagdish C. Sehra; Venkat S. Iyer; Koyalagunta Ravindranath**, all of Pune, India

[73] Assignee: **Council of Scientific & Industrial Research**, New Delhi, India

[21] Appl. No.: **878,932**

[22] Filed: **May 5, 1992**

[51] **Int. Cl.**[5] **C08G 64/40**
[52] **U.S. Cl.** **525/463**; 528/196; 528/199; 528/371
[58] **Field of Search** 525/463; 528/371, 199, 528/196

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,107,143	8/1978	Inata et al.	528/176
4,452,968	6/1984	Bolon et al.	528/271

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52-109591	9/1977	Japan .
55-98224	7/1980	Japan .
110376	4/1968	United Kingdom .
WO90/07536	9/1989	World Int. Prop. O. .

Primary Examiner—Harold D. Anderson
Attorney, Agent, or Firm—Pennie & Edmonds

[57] **ABSTRACT**

The invention disclosed is an improved process for the preparation of high molecular weight poly(arylcarbonate), the molecular weight ranging from 45,000–60,000 (corresponding to n_{inh} 0.8 to 1.0) The process involves heating in a controlled manner, a BPA-polycarbonate oligomer in the presence of a catalyst selected from alkali metal aryl acid, alkali metal borohydrial and a quarternary ammonium salt of bioxiyanion derived from a carboxylic acid poly(arylcarbonate)s of high molecular weight produced by the process of present invention show enhanced crystallinity.

6 Claims, No Drawings

Published in Macromolecules, 26, 1186 (1993)

Genesis of CSIR 's IP Policy 1996

" The history of CSIR's recent patent successes has origins in the patent filed on May 5, 1992 by S.Sivaram et al of National Chemical Laboratory , Pune (US Pat 5,266,659 dated 30 November 1993) with the assignee as CSIR. This was followed by what was to be a milestone in Indian patenting history , when GE showed immense interest in the work pertaining to the NCL patent "

Current Science, 85, p.571, 10 September 2003

Power of Exemplary Claim : The case of Solid State Polymerization of Polycarbonates

PCT WO 9007 536 , July 12 , 1990 to Asahi Chemicals

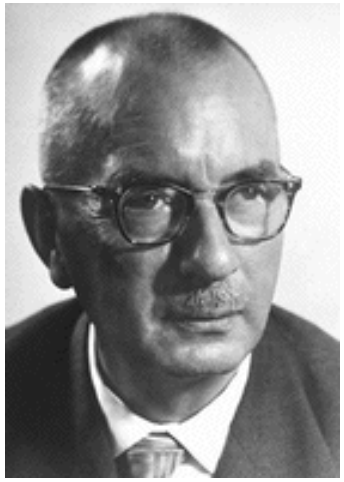
CLAIMS

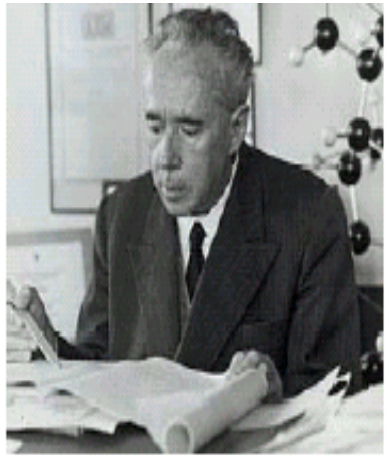
1. A porous, crystallized, aromatic polycarbonate prepolymer comprising recurring aromatic carbonate units and terminal hydroxyl and aryl carbonate groups, wherein the molar ratio of the terminal hydroxyl groups to the terminal aryl carbonate groups is from 5/95 to 95/5, and having a number average molecular weight of from 1,000 to 15,000, a specific surface area of at least 0.2 m^2/g and a crystallinity of at least 5 %.

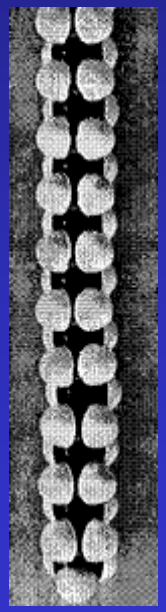
2. A prepolymer according to claim 1, wherein the specific surface area of the prepolymer is at least 0.5 m^2/g.

Lesson : Understand the power/drafting of exemplary claims; Well drafted exemplary claims give you the power to effectively exclude others

METAL CATALYZED OLEFIN POLYMERIZATION







BUNDESREPUBLIK DEUTSCHLAND

AUSGEGEBEN AM 14. APRIL 1960

DEUTSCHES PATENTAMT

PATENTSCHRIFT

Nr. 973 626

KLASSE 39c GRUPPE 25 01

INTERNAT. KLASSE C 08 f

Dr. Dr. e. h. Karl Ziegler, Mülheim/Ruhr,
Dr. Heinz Breil, Oberhausen (Rhld.), Dr. Erhard Holzkamp, Düsseldorf,
und Dr. Heinz Martin, Mülheim/Ruhr
sind als Erfinder genannt worden

Dr. Dr. e. h. Karl Ziegler, Mülheim/Ruhr

Verfahren zur Herstellung von hochmolekularen Polyäthylenen

DE 973626
Nov 18, 1953

CRYSTALLINE HIGH POLYMERS OF α-OLEFINS

Sir:

No crystalline polymers of olefinic hydrocarbons containing asymmetric carbon atoms in the principal chain of the macromolecules have been reported. Such a lack of crystallinity has been explained[1] by considering such polymers as copolymers of two types of random distributed monomeric units, differing only in the configuration of their dissymmetric group.

G.Natta
JACS 77, 1708, 1955
(March 20, 1955)

ZIEGLER-NATTA CATALYSTS AND POLYMERIZATION: THE BIRTH OF A SCIENCE

Process for preparing high molecular weight polyethylene,

Ger Pat 973, 626, 1960 dated November 18, 1953

to K. Ziegler, H. Breil, E. Holzkamp and H. Martin

- ***Exemplary claim***

  A method for preparing high molecular weight polyethylene using aluminum alkyls as catalysts, characterized by bringing together ethylene at pressures >10 atm and temperatures above 50°C with mixtures of aluminum trialkyls and compound of the metals of Group IVa to Vla of the periodic table with the atomic numbers 22 to 74

- **Land mark experiment carried out on October 26, 1953, in the Max Planck Institute fur Kohlen forschung in Mulheim an der Ruhr**
- **A patent was issued to Natta et al (US Pat 3, 112, 200 on June 8, 1954) for the preparation of isotactic polypropylene**

“I set out to follow a broad course of study in which my only guide was , initially, just the desire to do something which gave me pleasure. The course threw up many interesting conclusions , many of them of highly practical value, and one of them led ultimately to a method of making polyethylene “

Karl Ziegler

Nobel Address

CREATING VALUE TO CUSTOMER THROUGH INTELLECTUAL PROPERTY

- **GE - NCL Research Alliance established in 1995**
- **Ten year alliance, multi project and guaranteed annual funding**
- **Global teams (R&D, technology, marketing, production) focussed on challenging new product/process platforms**
- **Value of relationship judged based on creation of patents estate**

Strategy:

Offensive patenting strategy to create high barriers for competition to practice technology

PROVIDE SECURE TECHNOLOGY TRANSFER ROUTES

- **NCL develops a new process for a branching agent for high performance polymers (polyesters, polycarbonates, epoxies etc.) in 1996**
- **Process patented in India, US, Europe and Japan (five patents)**
- **The product is a single source item, manufactured by Celanese in US and protected by valid patents in force**

Strategy:

To create alternative lower cost vendors based on proprietary process <u>not infringing</u> on Celanese patents

Example: THPE, GE Plastics/ Excel

THPE: 1,1,1-tris-(4-hydroxyphenyl) ethane

THPE is used as a branching agent in polycarbonates. The branching agents employed are tri-functional or higher molecules which can incorporate within a linear aromatic carbonate polymer chain and have a functional group left for further reaction which provides the branched molecule. Various branching agents have been utilized in polycarbonate to prepare a branched polycarbonate. One of them is compound 1,1,1-tris-(4-hydroxyphenyl)ethane. The utilities for these branched polycarbonates include film, fibers, sheets, tubes, rods and in particular blow molding applications such as bottles and various containers.

NCL developed a non-infringing, patented process for making THPE. NCL also developed a toll manufacturer for THPE in India for GE Plastics. Till then, THPE was produced by a single manufacturer in the world who could charge monopolistic prices.

PROVIDE SECURE TECHNOLOGY TRANSFER ROUTES

- Process piloted at NCL in 1997. Basic engineering package developed
- An Indian company chosen for technology transfer; process demonstrated in 1998
- Patents and process licensed to the Indian Company in 1998
  - NCL/CSIR provides limited indemnity to the Indian company against infringement.
- Indian company begins trial production in 1999 large users in US sampled for product acceptability ;commercial negotiations with customers concluded
- Indian company secures firm purchase contracts for commercial sale of product from 2 US Companies

PROVIDE SECURE TECHNOLOGY TRANSFER ROUTES

- **WHAT DID WE ACHIEVE?**
  - **Wealth and job creation in India**
  - **Globally competitive technology, both in terms of patents/cost**
  - **Breaking the monopoly status of a supplier**
  - **Confidence in creating world class technology and products from India for global markets**

PATENTS AS A SOURCE OF INFORMATION FOR COMPETITIVE ASSESSMENTS/INTELLIGENCE

- **Patents are a valuable source of information to track technology trends**
- **Science as evidenced in patents is often never published; even when published it is after a long gap**
- **Systematic "patent watch" can lead to valuable insights into competitive strengths of companies**
  - **Intensity of R&D in a given area**
  - **"Peaks" and "troughs" corresponding to waxing and waning of technology interests**
  - **Identification of 'hot' areas of research**
  - **Identification of "Invention and Innovation gaps"**
  - **Identification of new science leading to technology**

TECHNOLOGY TRANSFER FROM RESEARCH LABORATORY TO COMMERCIAL PRACTISE LEADS TO...

- **Creation of wealth**
- **Creation of jobs**
- **New solutions to society's problems**

CREATING WEALTH OUT OF INTELLECTUAL PROPERTY

- Curiosity driven research initiated in 1989 in the area of high performance materials
- Research performed by Ph.D students
- Research aimed at new processes to make poly(carbonate)s and poly(ester - carbonate)s without phosgene and at substantially lower temperatures, than hitherto practised
- Research resulted in three Ph.D thesis, eight US patents and several publications
- Negotiations with GE Plastics initiated in 1993 for sale of patents on “as is where is” basis; negotiations concluded in 1995 with GE Plastics licensing all the NCL - CSIR patents
- Ratio of value earned to research cost ~ 100

First example of licensing from CSIR

From little acorns do tall oaks grow

United States Patent: 5,288,838 - Microsoft Internet Explorer

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Address

United States Patent

Sivaram , et al.

Preparation of polycarbonates with biocyanion catalyst

Abstract

The invention discloses an improved process for the preparation of aryl polycarbonates. The process involves reacting aryl carbonate and dihydric phenol in the melt phase with a catalyst belonging to the class of quaternary ammonium biocyanions having the general formula ##STR1## Wherein 'X' represents a carboxylate or a phenolate group or a mixture there of and 'R' represents alkyl or aryl.

Inventors: **Sivaram; Swaminathan** (Maharashtra, IN); **Sehra; Jagdish C.** (Maharashtra, IN); **Iyer; Venkat S.** (Maharashtra, IN); **Bhardwaj; Ishwar S.** (Gujarat, IN); **Satish; Sheo** (Gujarat, IN)

Assignee: **Council of Scientific & Industrial Research** (New Delhi, IN)

Appl. No.: **865951**

Filed: **April 9, 1992**

Current U.S. Class: **528/199**, 528/196, 528/198

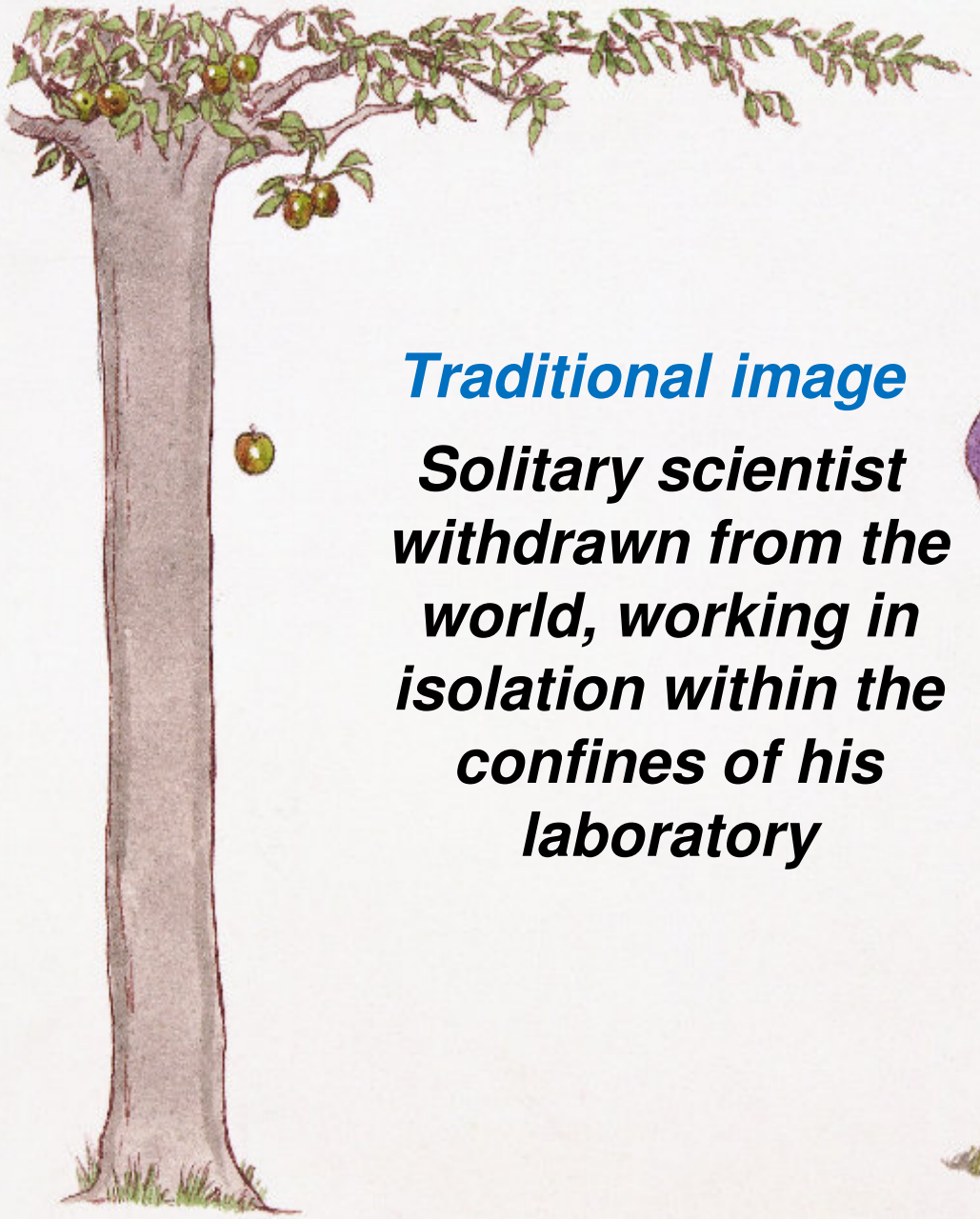
Int'l Class: C08G 064/30

Done Internet

INTEGRATING PATENT LITERATURE IN SCIENCE EDUCATION

- Patents are a valuable source of useful information
- Reading, understanding and extracting the information from a patent is an art which can be learnt only by practice
- Seek to find what is not said in a patent, rather than what is said
- One needs comfort with words like, “comprising”, “comprising of” and “consisting essentially of”
- Reading and writing patents is a useful adjunct to the training of a scientist
- Over two third of my Ph.D. students have authored patents; patent summary often part of introductory chapter

Lesson : Integrate patent literature into the literature of science; Encourage patent citations in thesis; Encourage students to write patents



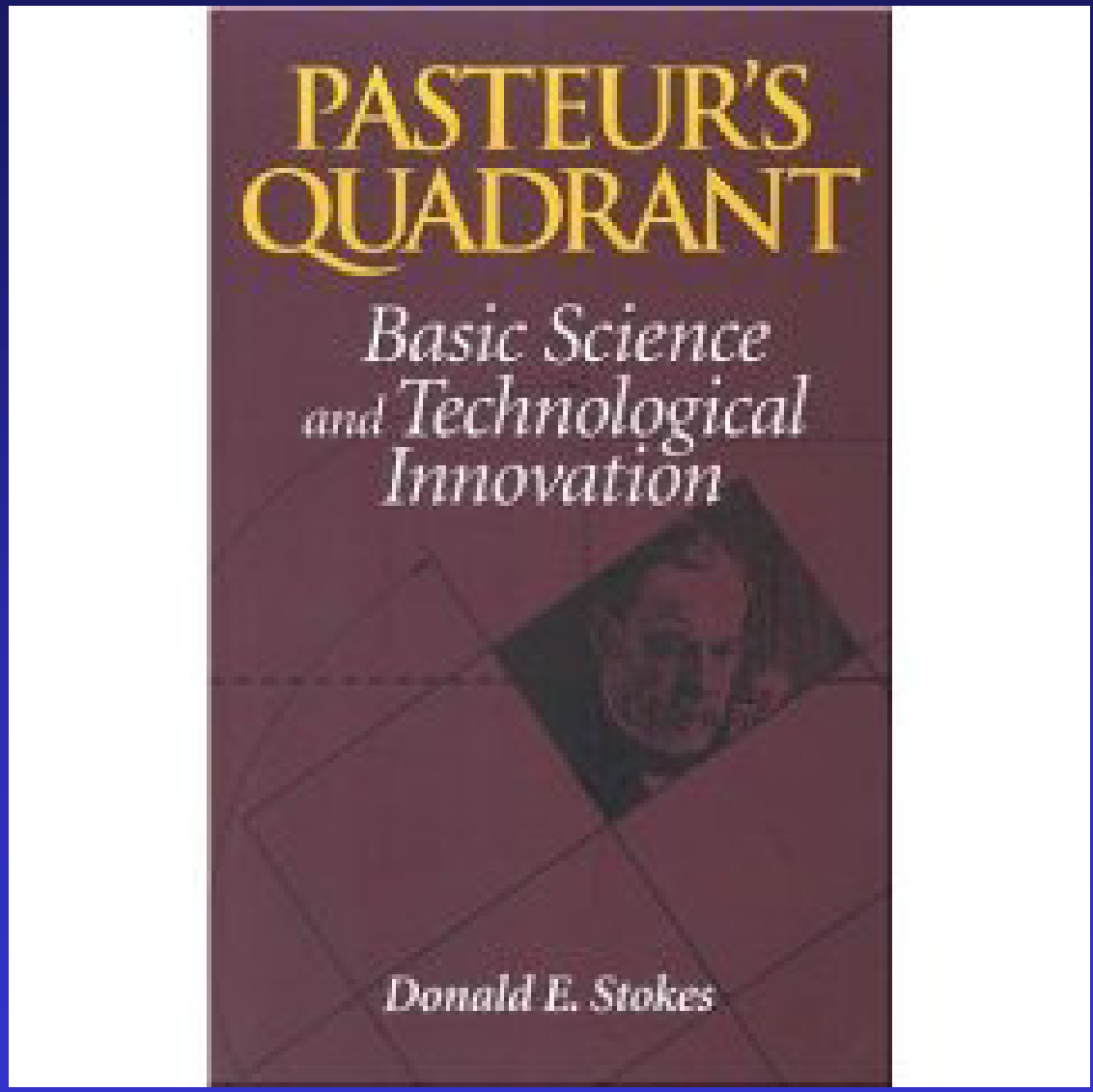
Traditional image

Solitary scientist withdrawn from the world, working in isolation within the confines of his laboratory

SCIENTISTS SOLO OR CONCERTED

AH Cottrell The Listener 1960 Sept 13 411

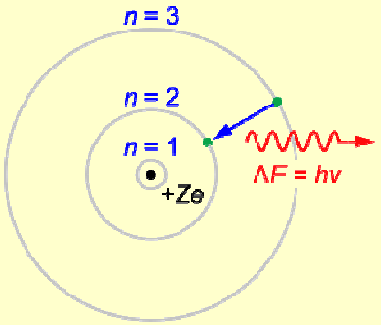
- **The scientist however remote he may seem is bound closely to the scientific life around him. He cannot work in a vacuum. He both takes and gives in the scientific currency of his time.**
- **Keeping in touch is the thing, and that means meeting as many people working in the field**
- **This is because science is at heart a progressive evolutionary subject.**

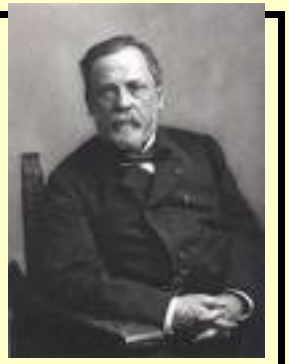

PASTEUR'S QUADRANT
Basic Science and Technological Innovation
Donald E. Stokes

1997

Pasteur's Quadrant

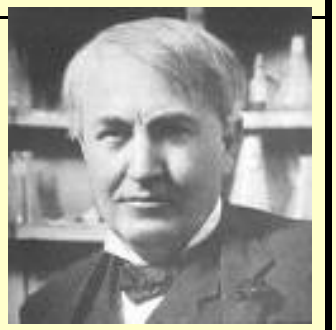
Bohr





Pasteur

Average
Academic
and
Industrial
R & D



Edison

Fundamental Research

Use Inspired Research

WHY SHOULD SCIENTISTS IN PUBLICLY FUNDED INSTITUTIONS BE INTERESTED IN TRANSLATING SCIENCE INTO PRODUCTS AND SERVICES

- **Institutional compulsions and demands**
- **Challenge of bringing good science to the market**
- **Creating wealth for the society and to themselves**
- **Altruism or doing good for the society which nurtured them; desire to act as agents of change in society**
- **Self actualization and growth motivation (highest in the hierarchy of human needs according to Abraham Maslow)**

At the end of the day, every scientist has this yearning for having been useful

REWARD OF SCIENCE

- **Robert Merton: Priorities in scientific discovery: American Sociological Review (1957)**
- **Eponymy**
- **Prizes**

Prizes and Attribution?


THANK YOU