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NANOTECHNOLOGY PATENTING: LEGAL ASPECTS AND ITS CONNECTION WITH INTELLECTUAL PROPERTY RIGHTS

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ABSTRACT

The manipulation or handling of things at the atomic and molecular level, or nanotechnology, has become a revolutionary area with usages across a variety of sectors, including producing goods, electronic devices, energy, and healthcare. Intellectual property rights (IPR), especially patents, are essential for promoting creativity and safeguarding technical breakthroughs because of their multidisciplinary character and economic viability. The regulatory structure controlling the patenting of nanotechnology is explored in the present article with particular attention paid to issues with patentability requirements, in international legislation, and the Indian statutory. This article emphasizes the importance of international agreements and domestic programs like India's Nano Mission, as well as the difficulties of originality, non-obviousness, and industrial usability in nanotechnology technologies. The paper ends with suggestions for bolstering patent frameworks to encourage the advancement of nanotechnology while resolving moral and legal issues.

KEYWORDS: *Nanotechnology, Patent, Nano Mission.*

1. INTRODUCTION

"Nano" is a phrase that comes from the Greek word meaning "dwarf." According to science, it is equivalent to one billionth of a meter. The manipulation or modification of matter at an atomic or molecular size, usually less than 100 nanometres, is referred to as nanotechnology. In other words, it is a study of matters which is working or revolving around on a certain atomic and molecular level scale. Materials frequently display distinct physical and chemical characteristics at this size. As the technology develops, new problems about

intellectual property (IP), especially in relation to patents, have been brought up by it being incorporated across different industries. The word nanotechnology was popularized by the person named K. Eric Drexier. In 1959, a famous speech delivered in the title of “There's Plenty of Room at the Bottom" by the U.S Scientist Richard Feynman, he put forward theories and scientific principles that is behind the functioning of nanotechnology. In his speech he never used the term “nanotechnology”, but disseminated the information about the procedure that will modify the natural characteristics of a single molecules and atoms. Since Norio Taniguchi first defined nanotechnology in 1974, it has developed into a multifaceted discipline with uses in electronics (nanochips), medicine (nanodrugs), and energy (solar cells).

2.IMPORTANCE OF PATENTING IN NANOTECHNOLOGY

An inventor can get a patent, which is a legal privilege that provides protection for a new product or method that has applications in the industry. It also encourages innovation by acting as an open-ended tool as well as an incentive. When it comes to nanotechnology, patents offer the exclusive right to sell and commercialize ideas based on nanotechnology. Patents, as opposed to copyrights or trademarks, demand strong evidence of inventiveness and innovation.

Nonetheless, there are particular difficulties with nanotechnology: - Wide-ranging patent claims might hinder competitiveness. Prior art searches are made more difficult by the absence of standardized terms. The regulatory supervision is required due to ethical and ecological implications. Nanotechnology has a wide range of uses:

- Nano-electronics-very tiny chips and transistors
- Drug delivery methods and diagnostic instruments in nanomedicine
- Nanomaterials-Quantum dots and carbon nanotubes
- Nano-energy-sophisticated fuel cells and solar panels

3.CRITERIA FOR PATENTABILITY IN NANOTECHNOLOGY

Section 2(1)(j) of the Patent Act,1970 defines an invention,

1. **Newness**- An innovation needs to be brand-new and unpublished in any form anywhere in the world before. Miniaturisation or molecular manipulation are frequently the source of innovation in nanotechnology.

2. **Step of Innovation** (Non-obviousness)- A person with expertise in the subject matter must not be able to provide an answer to that innovation, that is non-obviousness. Because nanotechnology intersects with other technologies, this is very difficult to fulfill these criteria.

3. **Application in the industry** - It should be possible for an industry to employ the invention. This is often met by nanotechnology's uses in electronics, manufacturing, and diagnostics.

3.1 Indian law's exceptions

Unless improved effectiveness is demonstrated, new versions of recognized chemicals cannot be patented under Section 3(d) of the Patents Act. A persistent worry has been the ambiguity around whether size reduction to the nanoscale counts as an innovative step.

4.NANOTECHNOLOGY PATENT TYPES

1. **Product patents**-safeguard final goods, such as carbon nanotubes.

2.**Process Patents** -Manufacturing techniques (such as chemical vapour deposition for nanomaterials).

5.NANOTECHNOLOGY PATENT CLASSIFICATIONS AND FILING

5.1 International Classifications

- India and more than 100 other countries use the International Patent Classification, or IPC.
- The USPTO (The United States Patent and Trademark Office) and EPO (European Patent Office) collaborated to create the CPC (Cooperative Patent Classification), which provides more specificity.

5.2 Indian Patent Filing Mechanism

- Governed by the Patents Act, 1970, and handled by the CGPDTM (Office of the Controller General of Patents, Designs and Trade Marks).
- Ordinary, conventional, and PCT (Patent Cooperation Treaty)

national phase applications are among the filing types.

- Initial filing is done using forms such as Form-1.
- Applications may be full or provisional.

5.3 Patent Phases in India

Patent filing often involves:

1. Fundamental Research-Research should be useful for the society and technological advancements
2. Prior Art Search (Google Patents, InPASS, EPO, USPTO)
3. Filing & Examination
4. Monitoring of Grants and Post-Grants

6. IMPORTANT AGREEMENTS AND RULES

- The Prior Informed Consent (PIC) process governs dangerous nanomaterials under the Rotterdam Convention.

- The second convention, the Stockholm Convention, deals with persistent organic pollutants (POPs), which may include Nano chemicals.

- The Basel Convention regulates the travel of hazardous waste, including nanoparticles, across international borders.

6.1 Efforts to Standardize –

- **ISO/TS 80004**: Specifies terms related to nanotechnology.
- **IEEE-NANO**: Encourages moral investigation and intellectual property safeguarding in nanoelectronics.

7. GOVERNMENT INITIATIVES IN INDIA

7.1 National Developments

India has made significant strides through:

- ✓ DST's Nano Mission (2007) with a ₹1000 crore budget.
- ✓ INUP **(**Indian Nanoelectronics Users Program**)**
- ✓ Centers of Excellence (IISc, IIT-Bombay)
- ✓ Nano Science and Technology Consortium **(NSTC)**

7.2 Timeline of Initiatives

- **1980s**- IRHPAS (Intensification of Research in High Priority Areas)– initial R&D support.
- **2001**-Launch of NSTI (National Skill Training Institute).
- **2006**-Establishment of National Knowledge Commission
- **2007-2016**: Nano Mission structured in 11th and 12th Five Year Plans.
- **2020**: AWSAR scheme launched to support 20,000 Ph.D. scholars.

8.NANOTECHNOLOGY CASE LAWS

Diamond v. Chakrabarty (1980)- Patenting of Microorganisms- The US Supreme Court established a precedent for bio-nano patents by upholding the patentability of genetically engineered organisms.

Orica Australia v. BASF- focusses on technological development and creative innovation, which are essential for breakthroughs at the nanoscale.

SmithKline Beecham Biologicals v. Wyeth (2003)- provides examples of how to analyse previous art and identify novel molecules in biotech and nanotech interfaces.

9. THE DIFFICULTIES OF NANOTECHNOLOGY PATENTING

The regulation and patenting of nanotechnology in India face several persistent challenges that complicate both legal interpretation and practical enforcement. One of the primary concerns is the absence of a clear and standardised legal definition of nanotechnology, which creates uncertainty for regulators, patent examiners, and innovators alike, making consistent application of the law difficult. This problem is further intensified by the overlapping nature of nano-based innovations, as many advancements are incremental developments built upon existing technologies, raising complex questions about originality, inventive step, and the extent of genuine technological advancement. In the pharmaceutical sector, these difficulties are particularly evident under Section 3(d) of the Indian Patents Act, where proving "enhanced efficacy" for nano-formulations of already known drugs remains ambiguous and legally challenging, often resulting in inconsistent outcomes. Beyond patentability issues, environmental and ethical concerns add another layer of complexity, as the long-

term safety of nanomaterials, disposal of nano-waste, and potential ecological impact are still insufficiently regulated. Moreover, existing patent law does not adequately address broader bioethical considerations, leaving critical gaps in the governance of nanotechnology despite its growing influence across healthcare, industry, and society.

10.COPYRIGHT AND NANOTECHNOLOGY

Although patents account for the majority of nanotechnology IPR, copyrights are also important:

I. Software Tools- Nano-design simulations and algorithms are protected by copyright.

II. Journals- Strict editorial and licensing guidelines apply to nanotech publications.

III. Education- Materials and lectures must adhere to copyright regulations.

11. SUGGESTIONS AND PROSPECTS FOR THE FUTURE

Building a strong and future-ready nanotechnology ecosystem in India requires coordinated efforts across policy, institutions, and industry. A key starting point is capacity building within the patent system, particularly through specialised nanotechnology training for patent examiners, so that complex nano-inventions are examined with technical accuracy and consistency. Alongside this, the adoption of unified and harmonised definitions of nanotechnology across jurisdictions would reduce ambiguity and improve legal certainty for innovators seeking protection in multiple countries. Public–private partnerships play an equally vital role by encouraging meaningful collaboration between academic researchers and industry, helping laboratory-level discoveries transition into commercially viable technologies. At the regulatory level, a balanced framework is essential one that supports innovation while ensuring that ethical concerns, environmental impact, and public safety are not compromised. The creation of dedicated patent data repositories focusing on nanotechnology disclosures would further strengthen transparency, research efficiency, and prior-art assessment. From a business perspective, intellectual property functions as a critical asset in the nanotech sector, with patents attracting investment and enhancing organisational value through commercialisation models such as licensing, franchising, and collaborative ventures. In recent years, government

support and robust IP protection have also enabled a shift from researchers to entrepreneurs, as many Indian academics are now converting nano-research into market-ready products. In the global context, countries like the United States and China currently lead in nanotechnology innovation, and for India to remain competitive, it must foster supportive innovation ecosystems and streamline patent procedures. With targeted legal and policy reforms tailored to the unique demands of nanotechnology, India holds strong potential to emerge as a global leader in this rapidly evolving field.

12. CONCLUSION

Driving innovation depends on nanotechnology patenting, but it also need for flexible legal systems to handle its special difficulties. India's Nano Mission and international treaties offer a basis; nonetheless, there are gaps in ethical supervision, regulatory control, and examiner experience. Development of responsible nanotechnology depends on cooperative efforts among governments, businesses, and academics. One frontier science with great power to change economies is nanotechnology. But the legal terrain controlling its protection especially with regard to patents remains complicated. Although Indian patent law offers a basic framework, it needs more sophisticated interpretation and change to fit the special character of nanotech innovations. To strike public welfare against innovation, international collaboration, standardizing, and ethical monitoring are just as vital.

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