

## **TWO RECENTLY DISCOVERED PATENTS OF PROFESSOR JAGADIS CHUNDER BOSE AND INDIA'S FIRST ELECTRONICS TECHNOLOGY TRANSFER TO THE WEST**

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Over one hundred years after the event, the present authors have recently discovered that Professor Jagadis Chunder Bose of the Presidency College, Calcutta, India had two additional patents issued to him in Great Britain hitherto unknown in India. These two newly discovered patents together with the known one taken in the United States of America represent India's first wireless electronics technology transfer to the West. In the creation of these Intellectual Properties, Professor Bose was helped by an angel investor, Mrs. Sara Chapman Bull of the United States. Mrs. Bull, in this effort was inspired by Swami Vivekananda who attended Bose's wireless research presentations at the International Science Congress held in Paris, France on 23rd October 1900.

This paper closely examines the historical time line of Bose's patenting activities. Incontrovertible evidence is presented to demolish a widely held false belief that Bose was against patenting any of his research products.

**Key words:** Diode Detector, J.C. Bose, Technology transfer to the West, Wireless detector patents.

### **1. INTRODUCTION**

In modern India, research and development activities in physical sciences spontaneously resurrected with the initiation of systematic experimental research on wireless waves by Professor Jagadis Chunder Bose [Fig. 1] at the Presidency College, Calcutta (now Kolkata) in 1894.

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**Fig. 1.** Statue of Professor Jagadis Chunder Bose at the Bose Institute, Kolkata, India (November 30, 2006). On the right is Dr. Francesco Paresce Marconi, a distinguished radio astronomer and grandson of wireless wizard Guglielmo Marconi.

Professor Bose was born on 30th November 1858 and was educated at St. Xaviers College, Calcutta and then at Christ's College, Cambridge University, Great Britain<sup>1</sup>. His physics teacher at Cambridge was Lord Rayleigh who was the first British scientist to receive the Nobel Prize in Physics for discovering the gas, Argon.

In his own initiative, Professor Bose began experimental researches at the Presidency College in 1894 on wireless waves which was then a new subject. He built his own equipments for experiments and worked with millimeter waves. One important part of his research was focused on inventing and building sensitive new detectors of wireless waves. A challenge of the mid 1890's was to replace the slow, mechanically tapped wireless wave detectors (then known as Branley or Lodge coherers— a small glass tube filled with iron filings and several improvements thereof) with the invention of a robust self-recovering one.

Professor Bose invented contact detectors involving metals and semiconductors<sup>2,3</sup> in 1898, resulting in self-recovering or self-restoring

In signing, the first or Christian name must always be written in full.

Witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

WITNESSES: *Jagadis Chunder Bose* (Inventor's Signature)

Two witnesses are required. *Thomas James Whitehead*

Name of place where oath is administered. *Kingdom of Great Britain*  
*County of London*

*Jagadis Chunder Bose,* the above-named petitioner, being duly sworn, deposes and says, that he is a subject of the King of Great Britain and Emperor of India and resident of Calcutta, India; that his postal address is Presidency College, Calcutta, India;

that he fully believes himself to be the original, first and sole inventor of the Improvements in or relating to detectors and so-called coherers for the detection of detection and indication of electrical disturbances, Hertzian waves, light waves or other radiations, and in electrical resistances described and claimed in the foregoing specification; that he does not know and does not believe that the said invention was ever known or used before his invention or discovery thereof, or patented or described in any printed publication in the United States of America, or any ~~foreign~~ <sup>foreign to the United States</sup> country before his invention or discovery thereof, or more than two years prior to this application; or in public use or on sale in the United States of America for more than two years prior to this application; and that no application for patent for said invention has been filed by him or his legal representative or assigns in any ~~foreign~~ <sup>foreign to the United States</sup> country, except as follows: In Great Britain, filed 9<sup>th</sup> May 1907, 30 July 1907, 12<sup>th</sup> September 1907, 14<sup>th</sup> September 1907.

Inventor's Signature: *Jagadis Chunder Bose*

Subscribed and sworn to and subscribed before me this eighteenth day of September 1907 at 65 and 66, Tavistock Square, London, England, as full, sole, and true inventor, under my hand and seal of office.

*W. Bridge* Notary Public

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Fig. 2. Professor Bose's hand-written application for a Patent in the United States on solid state diode detector device for wireless waves. [Courtesy of the National Archives, USA].

detectors thus making the mechanically tapped Branley and Lodge Coherers obsolete. Professor Bose's invention of the semiconductor diode detector involving a contact device with galena(lead sulfide) led to an application [Fig. 2] for a patent in the United States<sup>3</sup>. This patent became America's first

publication in the area of solid state devices. Over a hundred years later it is indeed fascinating to know that the first research publication of North America in the area of solid state devices was originated by an Indian scientist based on experimental research performed at the Presidency College, Calcutta, India !

## 2. J.C. BOSE'S TWO PATENTS IN THE GREAT BRITAIN

The present authors have recently discovered that Prof. Bose had two additional patents<sup>4,5</sup> in the United Kingdom, hitherto unknown in India. Front pages of these two patents are shown in Figs 3 and 4. Both of these patents

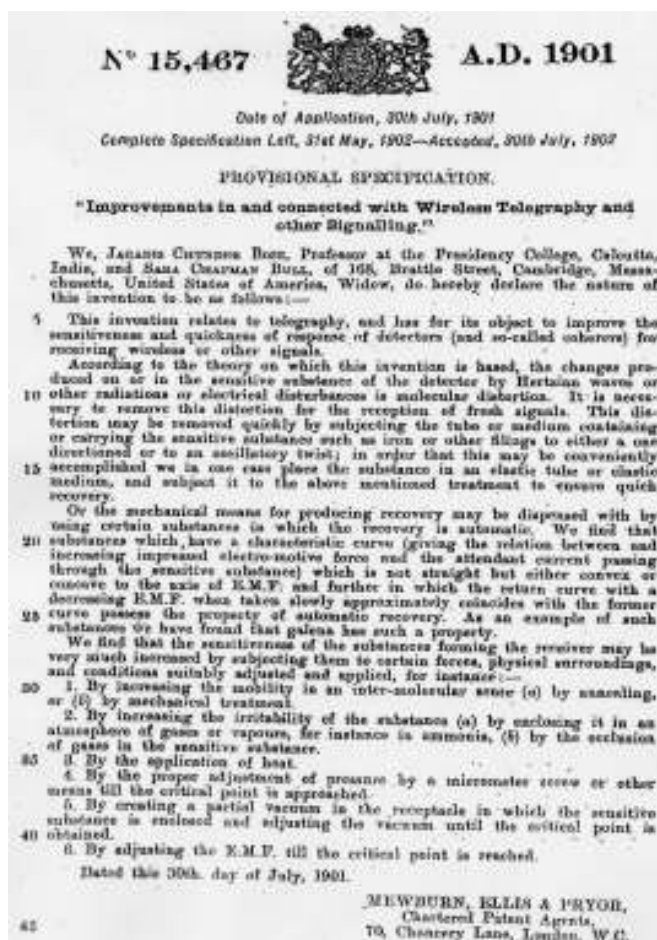


Fig. 3. The front page of Professor Jagadis Chunder Bose's first British Patent (No. 15,467).

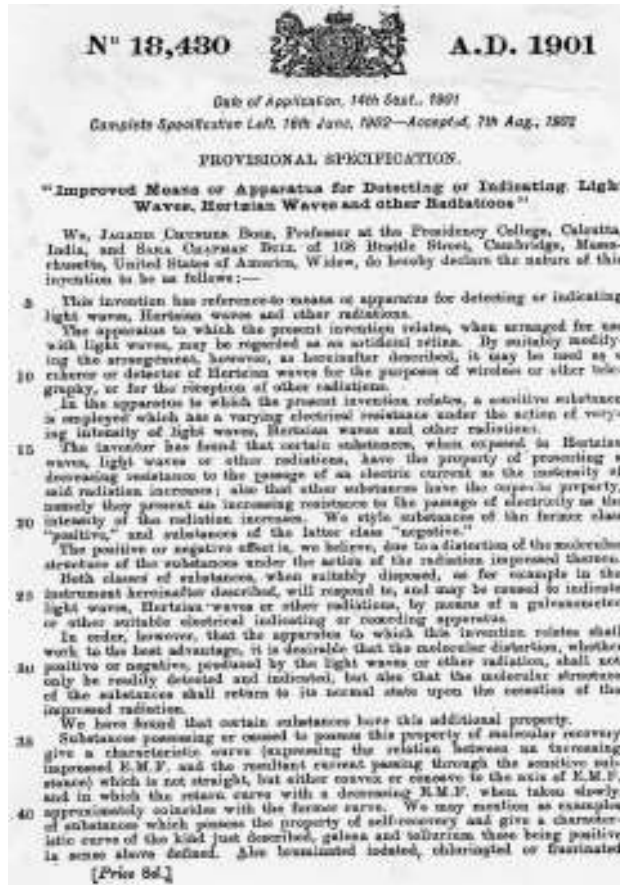


Fig. 4. The front page of Professor Jagadis Chunder Bose's second British Patent (No. 18,430).

deal with self-recovering solid state contact detectors of wireless waves. These are solid state diode detectors although the term 'diode' was not yet coined then.

Upon examination of these two patents it is immediately obvious that in these two recently discovered British patents there is a confusion between the inventors and the Intellectual Property Rights (IPR) owners. While Professor Bose is simultaneously the inventor and one of the IPR owners, Mrs. Sara Chapman Bull, the American widow mentioned in both of these British patents, is definitely not an inventor and the patent descriptions did not make that clear. This problem of confusion between the inventor and the

IPR owner with these two British patents must have taken place with Professor Bose's knowledge and consent. But his helplessness as a subject of the British Empire may have, perhaps, prevented him from disclosing in India of their existence. This, in turn, had serious implications in India with respect to correct understanding of Professor Bose's thoughts on technology commercialization and the correct promulgation of his achievements in the West. This very important issue will be addressed in a separate article in the very near future.

### 3. ANGEL INVESTOR SARA CHAPMAN BULL

Mrs. Sara Chapman Bull<sup>6</sup>, the American widow [Fig. 5], was the angel investor who provided financial support for Professor Bose's patent applications in the West. She became half owner<sup>3</sup> of the Intellectual Property Rights in the United States with respect to the U.S. Patent No. 755,540. Whereas, in Great Britain, she appeared to be part 'inventor' as well.



**Fig. 5.** Angel Investor Mrs. Sara Chapman Bull of the United States.

Ms. Sara Chapman Thorp (b. 1850, d. January 17, 1911), an American of Norwegian descent, was the daughter of an American Senator and second wife of famous 19th century Norwegian violinist Ole Bull. A musician herself, it is the violin that attracted her to this virtuoso, some forty years her senior, and she became a widow at the young age of thirty in 1880. A prominent scholar of independent mind herself, she used to organize regular philosophical seminars at her home in Cambridge, Massachusetts and was well ahead of her time. She wrote a biography<sup>7</sup> of her husband in which she included a chapter on the origin of violin which she found in her husband's handwritten notes. This knowledge about the origin of Violin, created in her an admiration and attraction for India long before she met, and was further impressed by inspiring lectures of, Swami Vivekananda in Cambridge, Massachusetts (Harvard University) during the mid 1890's.

At the invitation of Swami Vivekananda, Mrs. Sara Chapman Bull visited India in 1898 [Fig. 6] and met Professor Jagadis Chunder Bose in Calcutta and became aware of his pioneering research works in wireless waves.

#### **4. SWAMI VIVEKANANDA IN PARIS SCIENCE CONGRESS OF 1900**

Professor Bose in his third voyage to Europe arrived in England in August 1900 and then traveled to Paris, France in October 1900 to attend the International Science Congress and deliver a lecture there on his wireless research.

Swami Vivekananda, an erudite scholar and exponent of resurgent India [Fig. 6] during his return from his second world tour was also in Paris and attended Prof. Bose's lecture on 23rd October 1900. Description of this historically important rendezvous remains poignantly captured in the following words<sup>8</sup>:

Today is the 23rd October ; tomorrow evening, I am to take leave of Paris. This year Paris is a centre of the civilised world, for it is the year of the Paris Exhibition, and there has been an assemblage of eminent men and women from all quarters of the globe. The master minds of all countries have met today in Paris to spread the glory of their respective countries by means of their genius. The fortunate man whose name the bells of this great centre will ring today will at the same time crown his country also with glory, before the world. And where art thou, my Motherland, Bengal,



**Fig. 6.** Swami Vivekananda with Angel Investor Mrs. Sara Chapman Bull visiting Kashmir, September 20, 1898

in the great capital city swarming with German, French, English, Italian, and other scholars ? Who is there to utter thy name ? Who is there to proclaim thy existence ? From among that white galaxy of geniuses there stepped forth one distinguished youthful hero to proclaim the name of our Motherland, Bengal — it was the world-renowned scientist, Dr. J. C. Bose ! Alone, the youthful Bengali physicist, with galvanic quickness, charmed the Western audience today with his splendid genius; that electric charge infused pulsations of new life into the half-dead body of the Motherland ! At the top of all physicists today is — Jagadis Chandra Bose, an Indian, a Bengali ! Well done hero ! Whatever countries, Dr. Bose and his accomplished ideal wife may visit, everywhere they glorify India — add fresh laurels to the crown of Bengal, Blessed pair !

Mrs. Sara Bull also attended this lecture and became aware of Professor Bose's useful inventions of wireless detectors firsthand. Next year,



in 1901, she became actively involved in supporting Prof. Bose's patent applications in Great Britain and the USA.

### 5. THE VIOLIN CONNECTION

What is it that got Mrs. Sara Chapman Bull, an American widow, interested in India and motivated her to assist Professor. J. C. Bose financially to take the three patents in the West? This is of immense historical interest. The answer is the violin!

Her future husband, Norwegian violinist extraordinaire, Ole Bull [Fig. 7] charmed America with his superb performances during his numerous tours through various cities repeatedly for decades. He traced the origin of his magnificent instrument, the violin, and recorded the following in his Notes that found permanent place in his biography<sup>7</sup>:

**The Origin Of The Violin:** The country which affords us the most ancient memorials of a perfect language, of an advanced civilization, of a philosophy in which all phases of human thought find expression, of a poetry rich in every style, and of a musical art corresponding with the lively susceptibilities of the people - India - appears to have given birth to bow instruments. Classical antiquity, in its forms of sculpture and bas-relief, contains no suggestion of the instrument. A little figure of Apollo playing upon a kind of violin with something like a bow, exhibited in



**Fig. 7.** Famous Norwegian violinist of the nineteenth century Ole Bornemann Bull (b. February 5, 1810, d. August 17, 1880)

Florence, has been proved to be of modern production. This is the only known piece of sculpture reputed ancient, in which anything like a bow can be found. Ancient painting while giving many delineations of musical instruments, in every case fails to represent that indispensable adjunct of the violin proper, - the bow.

As to India, no conjecture based on obscure interpretation of record or delineation is needed, for the veritable instruments exist to-day, preserving, in the main, their original characteristics. The first or simplest form of bow instrument seems to have consisted of a little hollow cylinder of wood covered at one end with a piece of skin tightly stretched, and furnished with a neck and bridge, the whole being very much like a modern banjo. A slip of bamboo, bent so as to hold tense a bundle of hairs, furnished the bow. The number of strings was variable, according to the purpose of the instrument. Thus, in the case of the virtuoso, one string was deemed sufficient, while for the uses of the common people two or three were permitted. The antiquity claimed by Indian writers for this form of bow instrument is almost incredible; one tradition relates that it was invented by one of the early kings of Ceylon, at a period about five thousand years before the Christian era. In that dawn of history the migratory tides flowing from the East to the West from India through Asia, Persia, Arabia, thence through northern Europe, and thence across the Danube and the Rhine, have left other memorials than the stormy history of their wars. The polite arts of to-day find their crude germs in that ancient time. And although, by the ready interchange of ideas achieved by modern civilization, a modern invention may embody suggestions gathered from all countries and all times, it is possible to examine each component part, to follow up each relative train of thought which has here found practical expression, until we arrive at the single idea, the main-spring, as it were, of the whole mechanism.

In music the violin may be traced back through a thousand varied forms until it finds its beginning in the revanastron, or, as I have called it, the banjo-fiddle of India. At the time of its invention, it was undoubtedly designed for nothing higher than an accompaniment to the voice. As such it exists to-day in parts of India and Arabia, and in such menial capacity it was retained until about the 12th century. In fact, bow instruments did not come into special notice in Europe until about the 13th or 14th century.

## 6. THE HISTORIC TIME LINE OF BOSE'S PATENTING ACTIVITIES

The historical records of the British Patent Office<sup>9</sup> indicate that Professor Bose and Mrs. Bull jointly applied for patents on five separate occasions. Excerpts from the weekly British publication : *Illustrated Official*

*Journal (patents)* are shown in Fig. 8. The first provisional application for patents (No. 9697) was made on 9th May 1901 and appeared in the May 15, 1901 publication<sup>9</sup>. This date is historically significant as detailed in the next section.

The second provisional application No. 15,467 was made on July 30th, 1901 and appeared in the August 8th, 1901 publication.

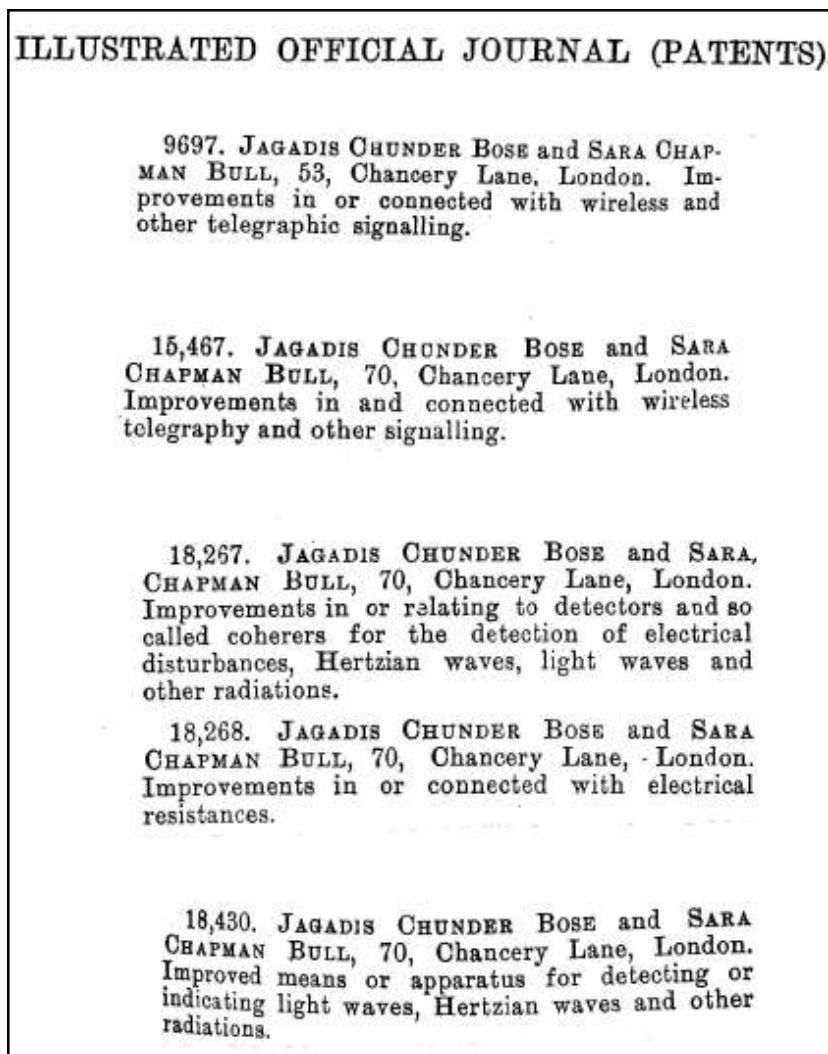


Fig. 8. Excerpts from historical records of Professor J. C. Bose's patent applications in Great Britain

This became the first British patent shown in Fig. 3. Although details of the first application has not yet been recovered(if at all it survived !), the title of the second application strongly suggests that it is a fresh resubmission of the first application. The third and fourth provisional application Nos. 18,267 and 18,268 were made on 12th September 1901 and appeared in the September 18, 1901 publication<sup>9</sup>. This fourth application(No. 18,268) whose content is not yet known, did not result in a separate patent.

The fifth provisional application No. 18,430 was made on September 14th, 1901. This application became the second British patent shown in Fig 4. Again, although details of the third application has not yet been recovered(if at all it survived !), the title of the fifth application suggests that it is closely related to the third application.

#### **7. PROFESSOR BOSE'S LETTER TO POET RABINDRANATH TAGORE**

During this European tour, Professor Bose was in regular correspondence with Poet Rabindranath Tagore, the Nobel Laureate of 1913. The letter of 17th May 1901, written in Bengali language<sup>10</sup>, where he describes an encounter with a multi-millionaire proprietor of a very famous wireless communication company is of particular significance. The relevant portion of this letter and its English translation is presented in Fig. 9.

A careful reading of this relevant portion of the letter together with the knowledge of Professor Bose's circumstances and his current research activities as presented in the said lecture, it becomes abundantly clear that Professor Bose was not at all against patenting his research products. This is eminently true as one can clearly see from the records of the British Patent Office, that Professor Bose himself had been applying for patents [Fig. 8], beginning 9th May 1901, on new wireless detectors invented by him in India earlier.

Records of his research activities show that on and around 17th May 1901 Professor Bose has moved away from the researches on new wireless detectors and was investigating other things. Further, and more important is the request that this multi-millionaire Proprietor had made to place prior restrictions on Professor Bose's freedom to disseminate his research findings through lectures and publications. Also, being merely a temporary visitor to the Royal Institution Laboratories and a subject of the colonial India, Professor

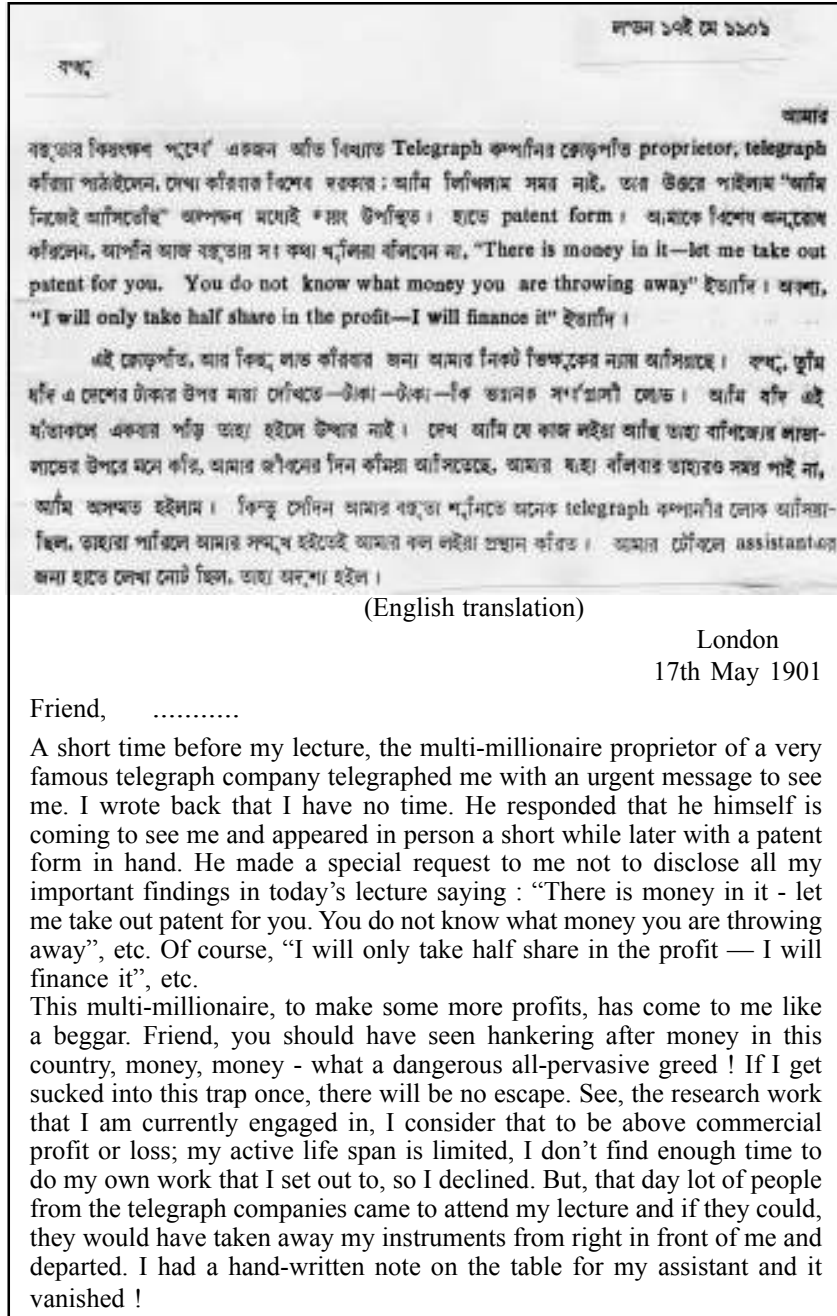


Fig. 9. Excerpts from the 17th May 1901 letter of Professor J. C. Bose to Poet Rabindranath Tagore and its English translation

Bose was not free to accept any such offers jeopardizing his employment at the Presidency College, Calcutta. Above all, Professor Bose who was 43 at that time explicitly said that he himself had no extra time to devote for commercial work beyond the new exciting research avenues that he was pursuing at that time. Simply put, correct interpretation of his actions and words (for example, see his Bose Institute dedication address<sup>1</sup> of 30th November 1917) confirm that while Professor Bose's research activities need not necessarily originate solely from commercial interests, he was not opposed to their commercial applications as long as it did not infringe upon his personal freedom to pursue whatever new researches he wanted to.

### 8. CONCLUDING REMARKS

Historical evidence is presented in this paper for the first time to demonstrate Professor Jagadis Chunder Bose's keen interest in establishing intellectual property rights in the West over a hundred years ago. In his dedication address for the Bose Institute on 30th November 1917 Professor Bose mentioned this effort in the following words<sup>1</sup>:

*India's Special Aptitudes in Contribution to Science:*

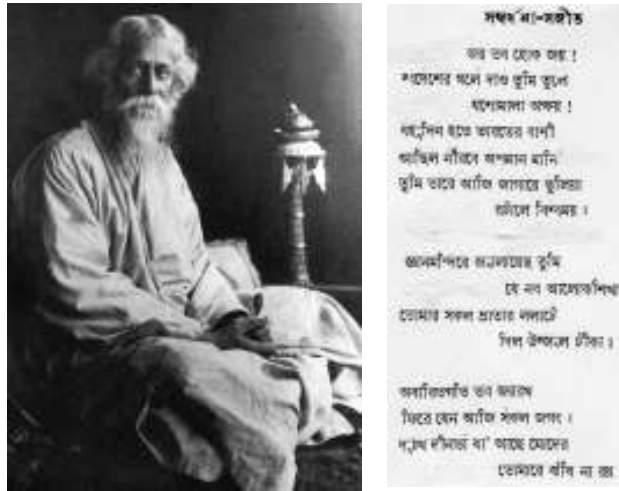
The invention of a new type of self-recovering electric receiver made of galena was the forerunner of the application of crystal detectors for extending the range of wireless signals.

A careful reading of the relevant portion of Professor Bose's letter to Nobel Laureate poet Rabindranath Tagore shows that Professor Bose was not against patenting his own research products. He was actually against any interference or obstruction in his current research and subsequent dissemination of the acquired new knowledge that he independently set out to do on his own.

As already shown, Professor Bose himself was applying for several patents when that encounter mentioned in the 17th May 1901 letter to Poet Tagore took place. Recent assertions that Professor Bose was against patenting of any of his research products has no basis in facts and is eminently false and misleading. This finding has profound research policy implications for the Bose Institute, present and future.

As quoted earlier, Swami Vivekananda left Paris for India the day after attending Professor Bose's lecture. Before the first British Patent of

Professor Bose was finally issued (see Fig. 3), Swami Vivekananda died on 4th July 1902 near Calcutta and never met Bose again. Both of these British patents were issued while Professor Bose was in London, England. He returned to Calcutta, India in October 1902. Poet Rabindranath Tagore composed the following song (Fig. 10) which was sung in a public felicitation given to



**English translation:**

Victory, Victory to you !  
 Anoint your motherland,  
 And make her proud with  
 Unforgettable ever-lasting glory !  
 For a very long time  
 Messages of India's new achievements  
 remained dormant in humiliating silence,  
 Now, you have resurrected  
 And spread it the world around !  
 The new light that you have lit  
 in the Temple of knowledge,  
 enlightened and brightened all your brothers  
 and made them very proud.  
 Your Victory Chariot is unstoppable,  
 Let it race around all over the world,  
 Whatever our present misery and short-comings are  
 Let those not deter you !

**Fig. 10.** Rabindranath Tagore and his song composed for triumphant public felicitation of Prof. Jagadis Chunder Bose on 3rd February 1903 in Bengali with English Translation.

Bose in February 1903. This song found a permanent place in Tagore's music collection : *Geetbitan*<sup>11</sup>. Following the original in Bengali, an approximate English translation is presented, for the readers to appreciate the inspiring spirit of the time and the occasion.

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