THE HISTORY OF THE APPEARANCE OF FIBER-OPTIC COMMUNICATION LINES

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Abstract. *Optic communication lines in the modern period of development in the field of telecommunications, as well as to familiarize with the work carried out in this area in Uzbekistan.*
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Introduction. In the era of digital technology, there is a huge demand for optical communication systems and technologies that work with it. We can say that optical communication systems are one of the important inventions that have made a fundamental twist in the field of telecommunications.

The use of light for information transmission has a long history. Initially, sailors used signal lamps to transmit information, while lighthouses alerted sailors of danger for many centuries. In the 90s of the XVIII century I.P.Kulibin (Russia) and K.Shapp (France) invented an optical telegraph, being unaware of each other's work. This optical telegraph worked on the basis of repelling sunlight using mirrors.

Sensing the convenience of light in transmitting information to a distance, the American inventor Alexander Graham Bell used focused sunlight in 1882 to establish an optical telephone (photophone) connection between the roofs of two buildings in Washington. He used his device to transmit sound through light to a distance of 200 meters. These systems provided proper transmission through the atmosphere.

The transmission of information in an open atmosphere did not show any result. Due to the fact that, the temperature in the atmosphere, air flow, dust, fog and other factors are constantly changing, it appeared that open air is unsuitable for working as a light - transmitting environment, so the idea of transmitting information along a light transmitter was identified as a solution to this problem by scientists in the 60s of the XX century. Until this idea was created, scientists conducted incessant scientific research on this matter.

Prepare Your Paper Before Styling.

First light transmitters were constructed in Russia in 1874-1876. Russian electrical engineer V.N.Chikolev used metal tubes with glass inside to illuminate several rooms with a single lamp. In 1905, R.Wood wrote in "Physical optics" that using "internal returns" from glass or, best of all, Quartz Rod walls, light energy can be transferred from one point to the other without major losses. During the 1920s and 1930s, the work on the transmission of electromagnetic waves through transparent light conductors (O.Shriver, U.Bregg) was carried out in Germany. In 1927, Baird (in England) and Hanzell (in the United States) came to the idea that too much fiber should be used to transmit images on television. In this way, until the 50s of the last century, the idea of transmitting images through a thin light transmitter, that is, fiber optics, developed. In 1951, a new stage in the development of fiber optic communication began: Van Heil (in the Netherlands),

Kapani and Hopkins(in England) began work on creating a robust adjustable device of fiberglass for transmitting images, being unaware of each other's work, and researching the laws of transmitting images. Such transmission required a large number of thin fibers, while their dense placement led to the passage of light from one fiber to another.

Van Heil's services became great when he solved the problems of light insulation in such light-transmitting fibers. In 1953, Van Xiil created a light-insulating shell fiberglass with a refractive index of 1.47 made of plastic (glass breaking index 1.5-1.7). His idea was that the refractive index of the light transmitter should be greater than that of the shell, so that a complete internal return of the light beam could be achieved. In 1958-1959, Kapani and Hirshovis confirmed the idea. They created fiberglass with a glass shell with a small Breaking index. Losses in this fiber are reduced compared to plastic shell fiber, another function of the shell that protects the polished fiber surface from external mechanical influences also occurs. Thus, from the work of Van Heil, Kapani and Hirshovis (period 1953-1959), the basic principle of fiber optics was laid down-the principle of transmitting light across two layers of dielectric light transmitters. All modern light transmitters work on this principle. In 1959 N.G.Basov, along with his colleagues, proposed the use of semiconductor materials to create solid-state light quantum generators. Such radiation sources were called lasers (Light Amplification by Stimulated Emission of Radiation-LASER). Scientists received the Nobel Prize in Physics in for this discovery in 1964.

Compared to conventional optical radiation sources, laser radiation has high monochromaticity, coherence as well as very high intensity, and therefore it was natural to use it as an eluting vibration in transmission systems. Laser radiation made it possible to form a wide transfer band.

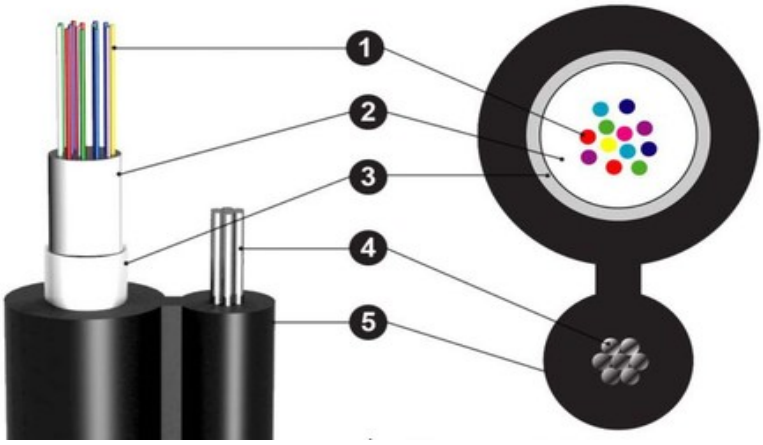
The helium-neon laser transmission system (wavelength x=0.63 μm in open space, frequency f=4.7-1014 GHz) has a 4,700 GHz (1% of the primary frequency) transfer band in which, around a million television channels can be deployed at a time.

In the 1960 s, many technical solutions were recommended to implement different types of modulation (frequency, phase, amplitude, intensity and polarization, pulse modulation) of laser radiation, as well as a number of laser transmission systems applying light scattering in open space. The above-mentioned disadvantages arise in the transfer of information in open space, as well as the small coefficient of useful work of sources of radiation used in such systems, limit their application in telecommunication networks.

Currently, despite a number of disadvantages, such systems are used in space, in some foreign countries in high-rise buildings with multiple floors.

The fading values of the optical fiber created at the time were large and estimated at about 1,000 dB/km. The light introduced into such a fiber is almost completely absorbed at a short distance. Many studies have been conducted to address this deficiency.

1. Optical fibers;
2. Optical module filled with hydrophobic filler;
3. Stel tape armor;
4. Central power element;
5. Polyethylene outer sheath.



1-figure. Fiber optic kabel(single mode).

In 1966, British scientists Kao and Hawkham analyzed the causes of light absorption in optical fiber in their scientific research and found that the main cause of light absorption was the residues of metal ions.

Scientists have proven that if Glass is cleaned of these ions, fibers with an absorption coefficient of a<20 dB/km can be obtained. After that, work on obtaining light-transmitting fibers with a small absorption coefficient on a global scale was very advanced.

In 1975, optical fibers with a fading coefficient of up to 2 dB/km were obtained in laboratory conditions, and by 1979 optical fibers with a fading coefficient of 0.2 dB/km were created. In 1980, many countries developed optical fibers with losses less than 10 dB/km, created semiconductor optical radiation sources with high reliability, photodetectors, and conducted comprehensive research on optical communication systems. In this way, the era of optical communication systems and, in accordance with it, the era of telecommunications, Optoelectronics and computer technology began.

In 1984, the first in Central Asia, the 234th and 241st automatic communication stations (ACS) of the Tashkent City telephone network, managed to launch a 4 km long multi - modal optical fiber 30-channel digital transmission system, and in 1988 the Zangiota district central communication Link (DCC) with the main switching center (DCC), a 120-channel 16 km long optical fiber transmission system was set.

USING THE TEMPLATE.

Nowadays, not only fading values have been created, but also one-mode optical fibers with minimal dispersion value, which are used in systems, compacted at Wavelength. This type of optical fiber was generated using zero chromatic dispersion to a 1.55 μm field. Such fibers are produced by many foreign companies, such as ”Corning” (USA), ”Fujikura” (Japan). There are direct international channels of the Uzbek telecommunication system, which go to 180 countries of the world in 28 directions. They also use fiber optics, as well as satellite systems.

In recent years, increasing the number of optical communication lines and technologies in our country and reaching the maximum number of internet users in our country has been the main task. In particular, the announcement of 2020 as the year of “Science enlightenment and the development of the digital economy” opened the door not only to an increase in optical communication lines, but also to great opportunities for the telecommunications sector.

The total length of communication networks in our country is now more than 25 million kilometers, and the number of base stations has reached 21 thousand. The number of users in the

mobile internet base in our republic is more than 22 million. In the first half of 2022 only, more than 22 thousand kilometers of optical communication lines were built. The length of fiber optic communication lines in Uzbekistan is 118 thousand kilometers. Currently, the work, carried out in the field of telecommunications in our republic, is reflected in international ratings.

According to the previous year's report of the UN international power communication union, Uzbekistan was among four countries that met the UN figure of 2% on broadband mobile internet prices. The Ministry of Information Technology and communications development of Uzbekistan plans to cover fully all residential areas of the Republic with high-speed Internet by 2026

The development of the field of telecommunication technologies, wireless communication and optical communication lines in our country has a huge impact on the development of Uzbekistan.

REFERENCES

1. T. D. Radjabov, A. M. Nazarov, A. A. Simonov, S. V. Pichko and Z. T. Khakimov, "Implantation of optical materials by rare-earths elements - erbium," 2007 3rd IEEE/IFIP International Conference in Central Asia on Internet, Tashkent, Uzbekistan, 2007, pp. 1-3, doi: 10.1109/CANET.2007.4401696.
2. T. D. Radjabov, Z. T. Hakimov and A. M. Inogamov, "Application of acoustic-optical rebuild filters for optimize the spectral characteristics of fiber-optical communication networks," 2010 4th International Conference on Application of Information and Communication Technologies, Tashkent, Uzbekistan, 2010, pp. 1-3, doi: 10.1109/ICAICT.2010.5612008.
3. D. A. Davronbekov and Z. T. Hakimov, "Joint Application of A Runiing Wave Amplifier and Acousto-Optical Configurable Filter for Linearization of The Passage Spectral Characteristics of Focles," 2020 International Conference on Information Science and Communications Technologies (ICISCT), Tashkent, Uzbekistan, 2020, pp. 1-4, doi: 10.1109/ICISCT50599.2020.9351490.