Working Principle of the Optical Splitter Patent



Overview

WO2015057484A1 The devices can operate as 3-dB splitters that divide the input optical energy equally between two output waveguides. Similarly, the devices.

Key Takeaways

Optical splitters divide an incoming optical signal into multiple output signals using waveguide structures, relying on multi-mode interference, adiabatic tapering, or mode conversion principles.

Spiral Waveguide Splitters

Some optical splitter patents use a spiral waveguide core surrounded by multiple adjacent waveguide cores. The input optical signal propagates through the spiral, and optical power is gradually coupled into the surrounding waveguides. This design leverages multi-mode interference (MMI), where overlapping modes in the spiral region interfere constructively and destructively to distribute power evenly or according to a desired ratio among the output waveguides.

Spiral designs reduce the footprint of the splitter while maintaining precise splitting ratios and are suitable for integration on photonics chips with electronic components for compact, low-cost systems (US12372720B2).



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Trident Structure Splitters

Another approach uses a trident structure, consisting of a tapered first waveguide that receives a multimode optical signal and two oppositely tapered second waveguides arranged on either side. The signal in the first waveguide is adiabatically split into two single-mode signals in the second waveguides. The tapering ensures minimal loss and smooth mode transition, making the splitter suitable for silicon photonics applications where low insertion loss and high fabrication tolerance are critical (EP3561561A1).

Asymmetric Taper and Mode Multiplexer Splitters

Some patents describe splitters that use asymmetric tapers to convert part of the optical signal from the fundamental mode to a higher-order mode. An optical mode multiplexer then separates the modes into different branches, converting the higher-order mode back to the fundamental mode at the output. This allows precise control of splitting ratios, including extreme ratios like 90/10 or 95/5, and supports broadband operation with low loss (US20240159963).

Y-SplittersTraditional Y-splitters divide the optical power evenly between two output waveguides. They are commonly used in Mach-Zehnder interferometers as 3-dB couplers. Modern designs improve tolerance to fabrication variations and reduce sensitivity to layer thickness, enhancing efficiency and reliability in integrated photonics systems (US20150104130).

Summary of Working PrinciplesMulti-mode interference (MMI): Uses interference patterns in a multimode region to distribute optical power. Adiabatic tapering: Gradually changes waveguide dimensions to split modes with minimal loss. Mode conversion and multiplexing: Converts part of the signal to higher-order modes and separates them into different outputs.

Waveguide geometry: Spiral, trident, or Y-shaped structures determine the splitting behavior and footprint. These principles allow optical splitters to achieve precise power distribution, low insertion loss, broadband operation, and compact integration in photonics chips for telecom, datacom, and sensing applications.

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Article Content

WO2015057484A1

The devices can operate as 3-dB splitters that divide the input optical energy equally between two output waveguides. Similarly, the devices can also function to combine two light beams into a...

US Patent Application for OPTICAL POWER SPLITTERS Patent

Optical splitters that split the power in a received optical signal into two output signals with output powers that are similar (e.g., splitting ratios of 50/50, 55/65, 60/40, etc.) are common and have low

20240159963 OPTICAL POWER SPLITTERS

An asymmetric taper can be used to convert a portion of the optical signal from the fundamental mode into a different order mode (e.g., the first-order mode). The optical splitter also includes an optical

OPTICAL POWER SPLITTER

A fundamental component in waveguide optics is an optical splitter, commonly referred to as a Y-splitter, which divides the optical power in an input waveguide evenly between two separate output

U.S. Patent for Optical power splitter Patent (Patent # 7,088,891 ...

An optical power splitter that can minimize the chip size with its manufacturing cost. The optical power splitter has one input optical waveguide and N output optical waveguides and splits an optical signal

WO/2025/139131 OPTICAL SPLITTER, OPTICAL NETWORK

An optical splitter, an optical network system, and a method for manufacturing the optical splitter. The optical splitter comprises a first housing (1), a second housing (2), an optical splitter chip

OPTICAL SPLITTER INCLUDING A TRIDENT STRUCTURE

The optical splitter comprise a tapered first waveguide configured to receive the multi-mode optical signal at its base and propagate the multi-mode signal. Further, the optical splitter comprises two

OPTICAL SPLITTER INCLUDING A TRIDENT STRUCTURE

In particular the present invention proposes an optical splitter with a trident (waveguide) structure, which is capable of propagating a multimode signal (e.g. the zero and first order modes of both TE and TM

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Optical power splitter

The optical power splitter has one input optical waveguide and N output optical waveguides and splits an optical signal incident from the input optical waveguide into N optical signals.

Understanding Fiber Optic Splitters: Principles,

The working principle of fiber optic splitters is based on the 1:N splitting principle. This principle allows a single input light beam to be split into N output light beams.

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Working Principle Of Optical Splitter

Optical splitter is a core passive device in FTTH system. Optical splitter, also called optical beam splitter, is an integrated waveguide optical power distribution device that can split an

Beam Splitters – optical power splitter, beamsplitter, thin-film ...

What are Beam Splitters? A beam splitter (or beamsplitter, power splitter) is an optical device which can split an incident light beam (e.g. a laser beam) into two (or sometimes more) beams, which may or

The Working Principle and Application Scenarios of Fiber Optic Splitters

The working principle of fiber optic splitters is based on optical coupling and splitting . When a light signal enters the splitter, it is divided into multiple outputs through interference effects or

Status and future development of distributed optical fiber sensors for ...

Another technique of fiber-optic sensors for temperature measurement is utilizing Rayleigh backscattering, which is the principle of optical frequency-domain reflectometry (OFDR) in distributed

How Do Fiber Optic Splitters Work, and What Are Their

Explore the workings of fiber optic splitters, their technical specifications, and wide-ranging industrial applications in this informative,

Detailed Explanation Of Fiber Splitters: Working Principle And ...

The working principle of fiber splitters is relatively simple, and the signal distribution is achieved through the principle of optical coupling in optical fibers.

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Understanding Beamsplitters: Types, Principles, and Applications

This article explores the fundamental principles and diverse applications of beamsplitters, detailing their different types and uses in fields such as optics and interferometry.

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