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PRESENTATION ON

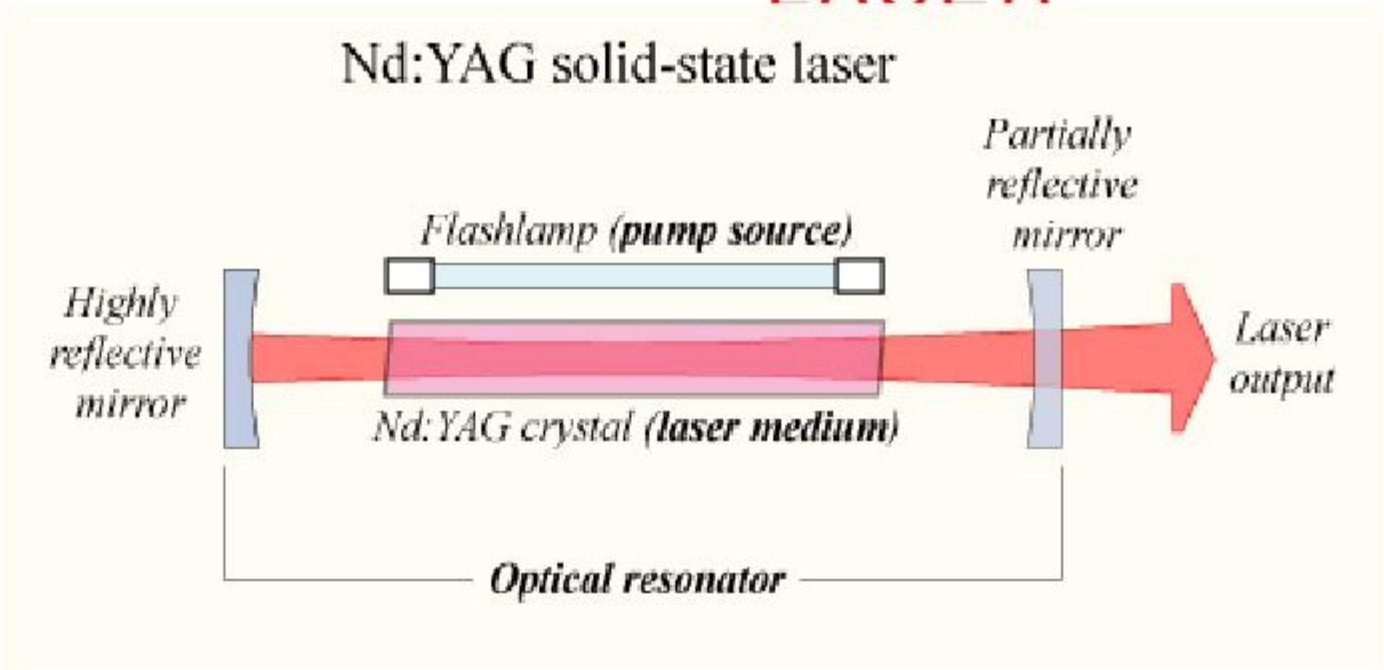
LASER SYSTEM

WELDING & CUTTING OF METAL

THE DISCOVERY OF THE LASER

The maser which was the predecessor of the laser and emitted microwaves was first built in 1953. Some of the first work done on the laser was started in 1957 by Charles Hard Townes and Arthur Leonard ' at Bell Labs. Their original work was with infrared frequencies but they later changed their focus to visible light and the optical maser which was how the laser was first referred to. Working independently of Townes and Schawlow and of each other were Gordon Gould a graduate student at Columbia University and Aleksandr Mikhailovich Prokhorov. All parties had the idea of using an open resonator which became an important part of the laser. In 1959 Gould applied to the US patent office for a patent for the laser but he was refused and the patent instead went to Bell Laboratories in 1960. The first working laser was built by Theodor Harold Maiman working at Hughes Research Laboratories in Malibu California.

FORMATION OF LASER



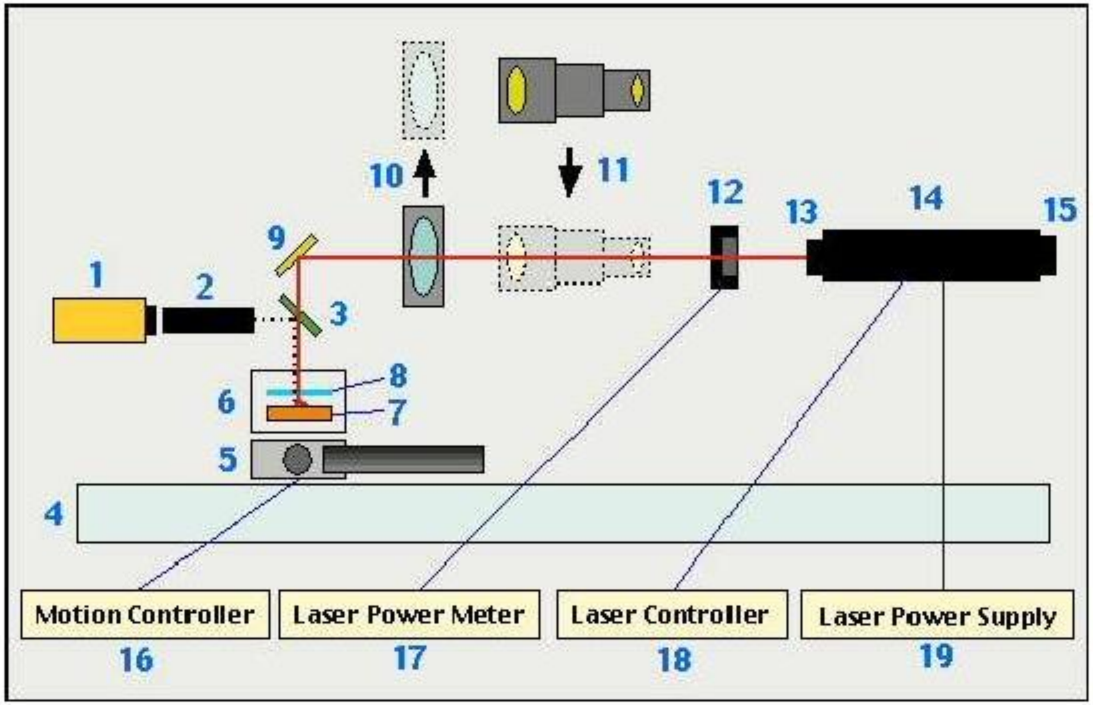
A laser basically consists of two main parts, an energy input and a gain medium. The energy input is called a pump source, in the above example it is a flash lamp but the pump source could also be an electrical power supply, a chemical reaction or another laser. The power source inputs energy which is called laser pumping energy, this is what drives the process which produces the laser light. The pumping energy is directed into the gain medium, this is the material which gives different lasers their individual characteristics. There are many different materials used as gain media including crystalline solids usually doped with transition metal ions or rare earth ions, gases such as CO_2 or. He, semiconductors such as gallium arsenide and liquids dyes.

CARBON DIOXIDE LASER

The **carbon dioxide laser** (CO_2 **laser**) was one of the earliest gas lasers to be developed (invented by Kumar Patel of Bell Labs in 1964), and is still one of the most useful. Carbon dioxide lasers are the highest-power continuous wave lasers that are currently available. They are also quite efficient: the ratio of output power to pump power can be as large as 20%.

The CO_2 laser produces a beam of infrared light with the principal wavelength bands centering around 9.4 and 10.6 micrometers

CARBON DIOXIDE LASER



- When energy is pumped into the gain medium it causes the particles in the medium to go into an excited state. Particle in this excited state may drop back to their ground state and when this happens they release their extra energy in the form of a photon of a specific wavelength. This photon may then collide with another particle, if this particle is in its ground state it will absorb the photon and become excited, if the particle is already excited the photon will cause it to drop to its ground state thus emitting another photon, this is called stimulated emission. Photons produced by stimulated emission are very similar to the inittial photon in terms of wavelength, phase and polarisation, this is what gives laser light its characteristics

If energy continues to be put into the gain medium then it will reach a state where there are more of the particles are excited then in the ground state, this is called population inversion. This means that a photon passing through the medium has more chance of causing stimulated emission then of being absorbed, the laser is therefore acting as a light amplifier. Mirrors are placed at the front and back of the gain medium. The mirror at the back is fully reflective but the one at the front is only partially reflective. These mirrors will cause photons emitted to pass through the medium many times until they pass through the front mirror and are emitted in the laser beam. This will increase the chance of photons colliding with particles and continuing the chain reaction.

HE- NE LASER

The beam in the cavity and the output beam of the laser, if they occur in free space rather than waveguides (as in an optical fiber laser), are often Gaussian beams. If the beam is not a pure Gaussian shape, the transverse modes of the beam may be analyzed as a superposition of Hermite-Gaussian or Laguerre-Gaussian beams. The beam may be highly collimated, that is, having a very small divergence, but a perfectly collimated beam cannot be created, due to the effect of diffraction. Nonetbeam diameter, and the angle at which the beam eventually diverges varies inversely with the diameter. Thus, a beam generated by a small laboratory laser such as a helium-neon (HeNe) laser spreads to approximately 1.6 kilometres (1 mile) in diameter if shone from the Earth's surface to the Moon. By comparison, the output of a typical semiconductor laser, due to its small diameter, diverges almost immediately on exiting the aperture, at an. In contrast, the light from non-laser light sources cannot be Q-switching, modelocking, or gain-switching. In pulsed operation, much higher peak powers can be achieved.