

Visual Inspection



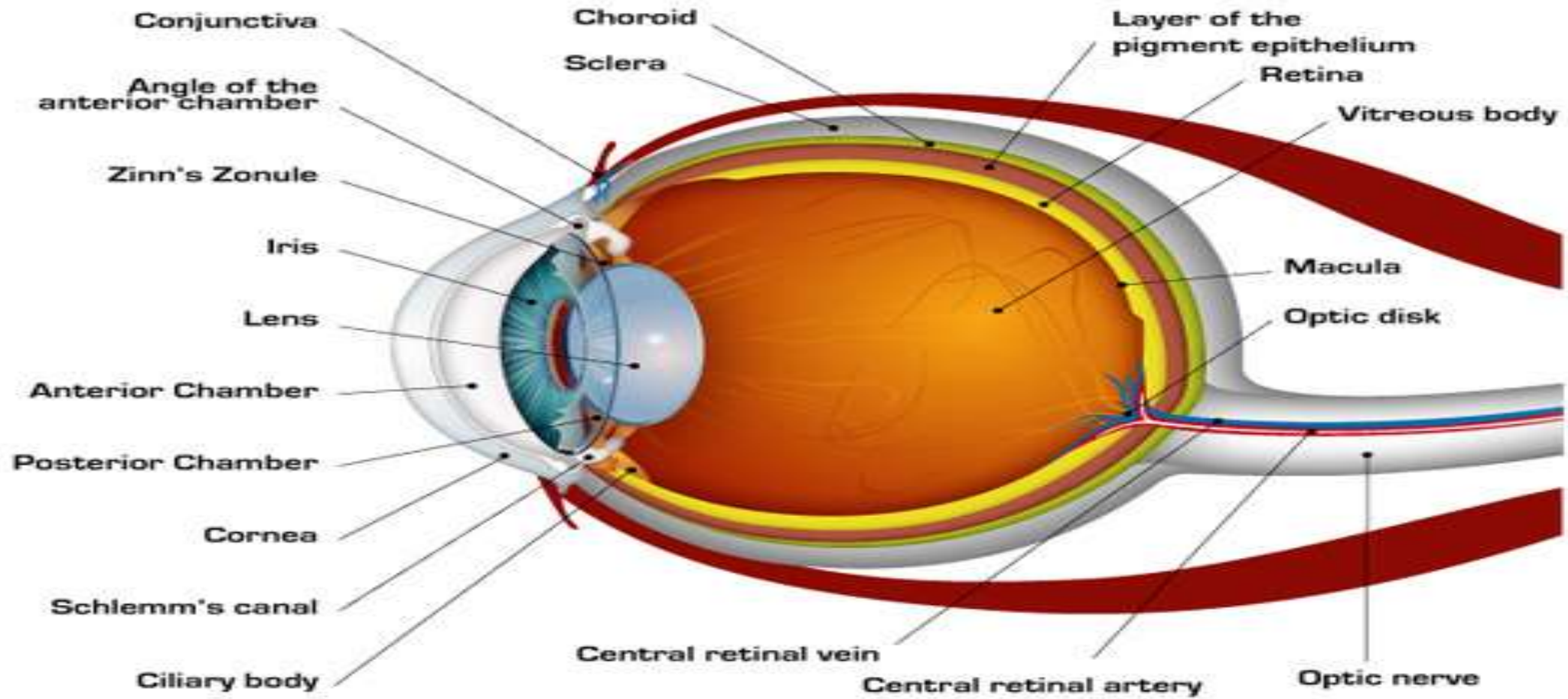
Introduction

- Visual inspection is commonly defined as “the examination of a material, component, or product for conditions of nonconformance using light and the eyes, alone or in conjunction with various aids.
- Visual inspection often also involves, shaking, listening, feeling, and sometimes even smelling the component being inspected.
- Visual inspection consists of at least two major processes.
 - The first is a search process.
 - The second is a process of combining relevant knowledge, sensory input, and pertinent logical processes to provide an identification that some anomaly or pattern represents a flaw that poses a risk to the performance of the part.
- Visual inspection is commonly employed to support other NDT methods.
- Digital detectors and computer technology have made it possible to automate some visual inspections. This is known as “machine vision inspection.”

Introduction

- The quality of an inspection are affected primarily by four factors.
 - The quality of the detector (eye or camera).
 - The lighting conditions.
 - The capability to process the visual data.
 - The level of training and attention to detail.

VISION



Vision

The eye

- Human eye is the most valuable NDT Tool
- Sensitivity of the human eye varies according to the light source
- Human eye has an excellent visual perception
- Yellow green light of wavelength 5560°A is the most suitable light for human eye at normal condition.
- Humans inspector are not allowed to work for more than 2 hours continuously in order to increase efficiency.
- Lighting should be adequate for inspection approximately 800-1000 lux.

Techniques

- Broadly speaking, visual inspection is divided into several viewing techniques:
- Direct viewing – viewing of an object in the operator's immediate presence. This can be unaided or by using equipment.
 - The most common tools used by inspectors include callipers, gauges, templates, micrometres, rulers, levels, chalk, illumination devices, note taking devices, and other miscellaneous equipment
- Remote viewing – viewing of an object not in the operator's immediate presence. This can only be done using special equipment.
 - instruments include mirrors, borescopes, charged coupled devices (CCD), and remote miniature cameras

Advantages of visual inspection

It can be a very simple but effective test to perform and often does not need expensive equipment.

Experienced operators and advanced equipment make it possible for visual inspection to be very sensitive .

It allows discontinuities to be seen through naked eye.

Many different surface-breaking discontinuities can be found.

Training and experience times can be short.

Virtually any component can be examined anywhere on the surface.

Disadvantages of visual inspection

It relies totally on the human factor.

Many organizations pay little attention to the proper training of operators.

Sub-surface discontinuities will not be seen.

Types of Visual Inspection

- 1. Unaided Visual Inspection
- 2. Aided Visual Inspection

1. Unaided Visual Inspection

- It is also Known as Direct Visual Inspection
- It can be accomplished with the help of naked eye
- It can done with out the help of optical aids
- Defects can be detected are
 - Absence of cracks, Corrosion layer, surface porosity, Misalignment of mated parts

2. Aided Visual Inspection

- It is also known as Indirect Visual Inspection
- It is performed using optical instruments
- This will identify the defects which cannot detect with human eye
- It permits visibility to areas are not accessible to human eye

LIGHTING

- Important factor
- Amount of lighting depends on type of test, speed, accuracy vision etc
- Lighting should not affect inspector health
- Approximate suitable lighting 800-1000 lux
- Various light sources
 - incandescent lamp
 - Fluorescent lamps
 - High intensity discharge lamps



HIGH INTENSITY DISCHARGE LAMPS



mercury vapor



high pressure sodium



metal halide



Material Attributes/ factors affecting VI

- Surface conditions

- Cleanliness
- Color
- texture

- Physical conditions

- Specimen Conditions
- Shape
- Size
- temperature

- Environmental Factors

Atmosphere

Cleanliness

Humidity and temperature
safety

Physiological factors

Physical comfort

Health

Mental Attitude

Fatigue

Test item position

Visual Perception

- It is the interpretation of impressions transmitted from retina of eye to the brain in terms of information
- Visual perception depends on the vision acuity
- Human eye has an excellent visual perception

it involves following steps,

- Recognising presence of defect in specimen
- Identifying it
- Locating the defect in the specimen
- Finding out its relation with the surface
- Identifying its features like size, shape, colour, etc

Visual Testing Requirements:

Mirrors (especially small, angled mirrors),
Magnifying glasses,
Microscopes (optical and electron),
Borescopes and fiber optic Borescopes,
Closed circuit television (CCTV) systems,
Videoscope.
Lights
Fibrosopes

Tools Used in Visual
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**Tools Used in Visual
Inspection**

Visual Testing Equipments



Fig: Videoscope



Fig: Advanced Videoscope



Fig: Borescopes



Fig. Microscope



Fig: Magnifying glass

Magnifying Mirrors

- It is also known as concave spherical mirrors
- It is used to magnify the areas which are not accessible to human eye.



Magnifying Glass

- It is also called as Hand Lens
- This lens is used to produce a magnified Image
- Magnification depends upon the position where it is being placed between the human eye and the object
- For higher power magnification, double or multiple lenses are used



Microscope

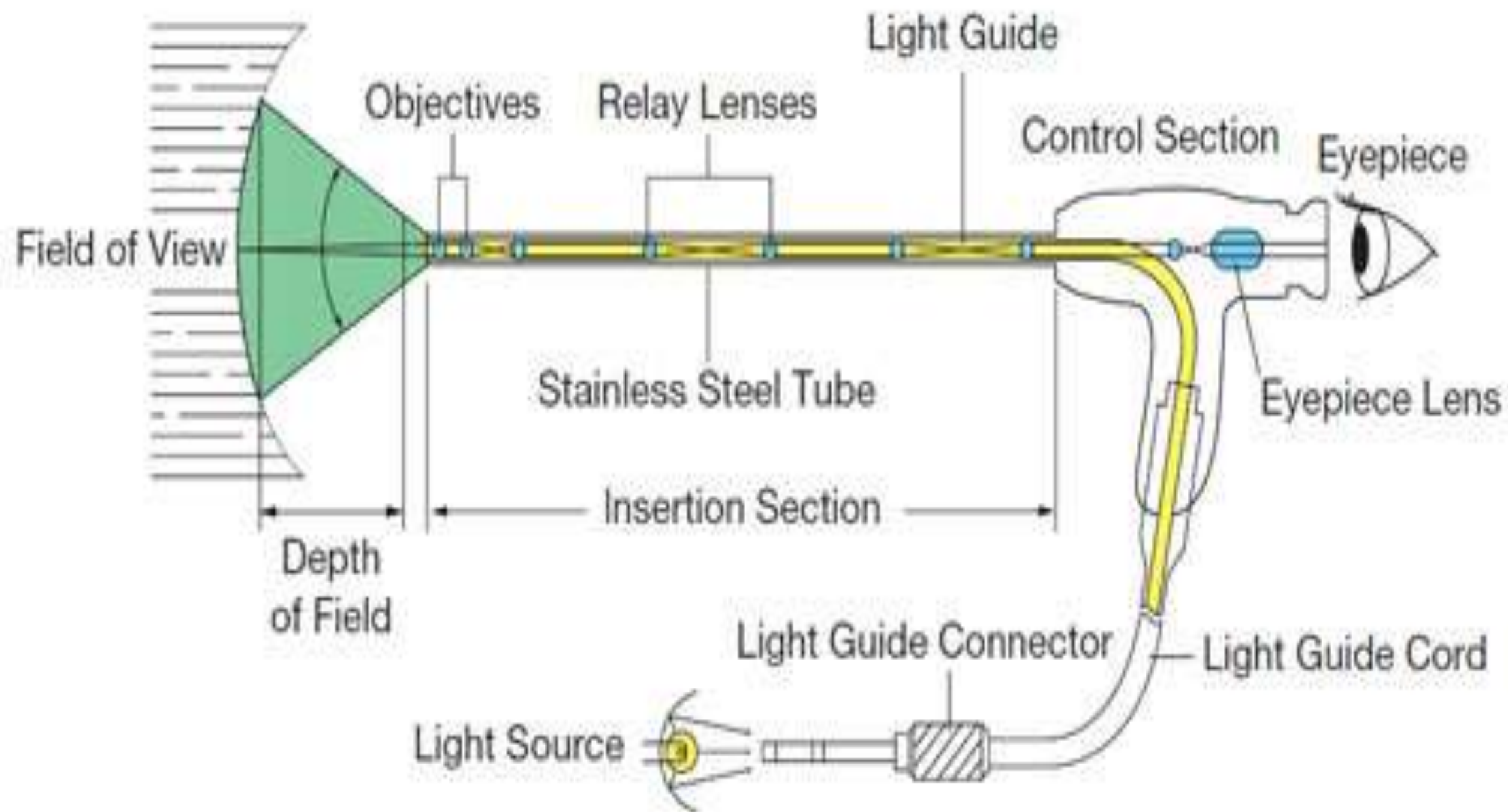
- Microscope is used to magnify the image of a small object
- Magnification Power = $10/F$

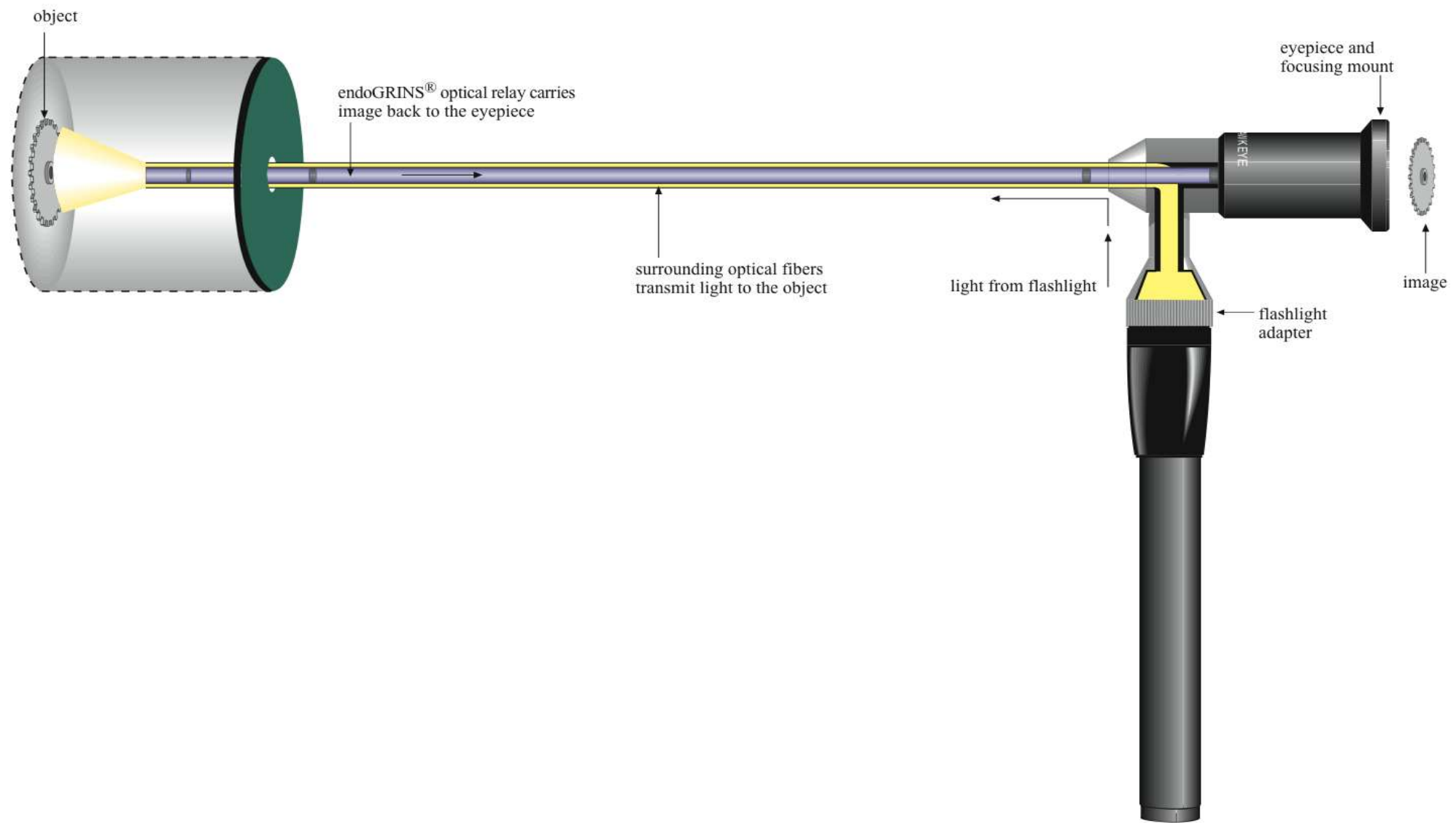


Borescope

- Which is used to inspect the inside of a narrow tube
- It is a flexible tube with an eyepiece at one end and objective lens at another end
- Light is passed through the lens and to obtain a clear image
- Available range is 2.5 mm to 19 mm
- Video







Borescopes

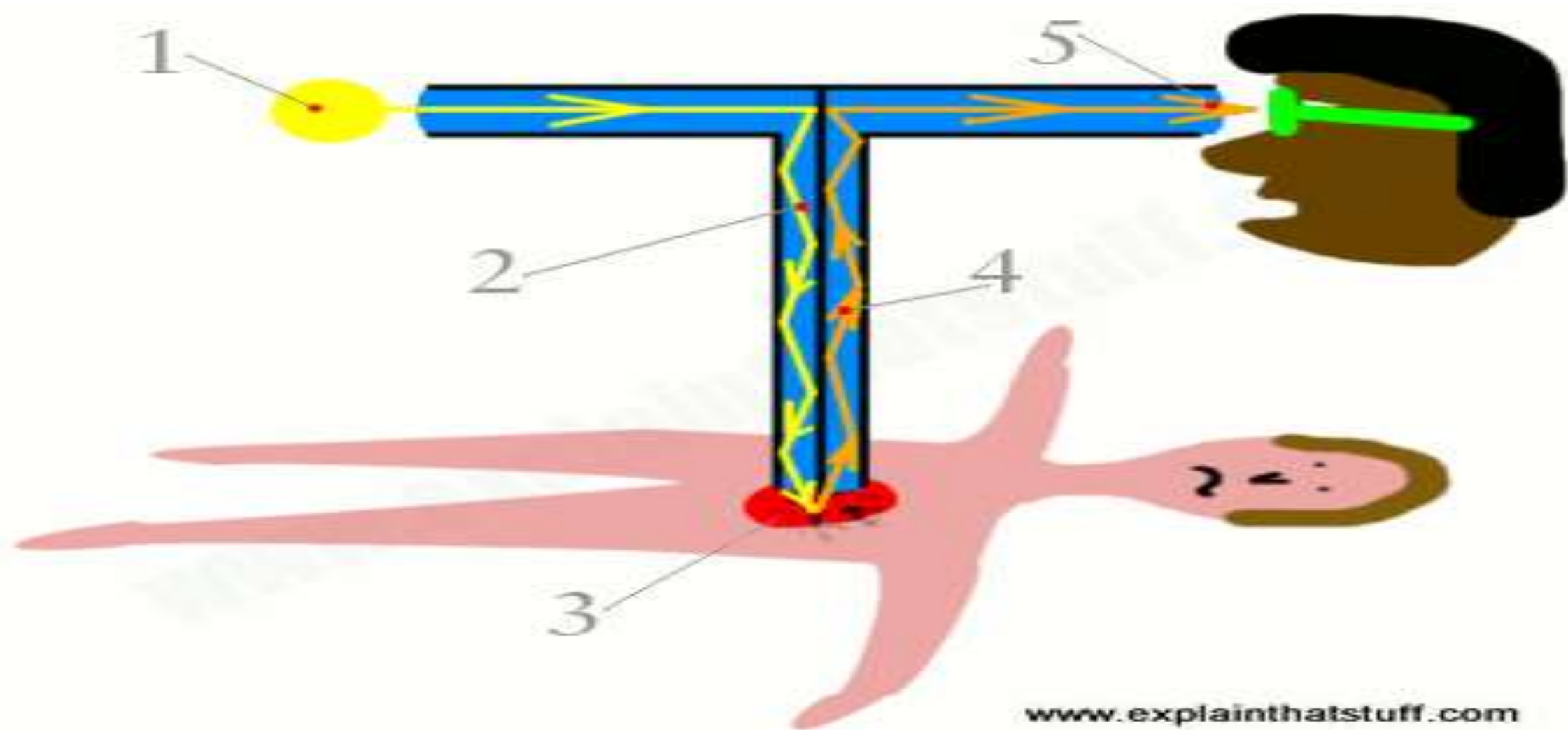
- A borescope is an optical instrument composed of a tube designed for the remote inspection of objects. A person at one end of the tube can view an image obtained at the other end.
- The image is transmitted through the tube via fiber optic bundles, running through the tube, camera, video projection system, or lenses.
- A borescope that utilizes fiber bundles for its image projection is commonly referred to as a fiber optic borescope or fiberscope.
- Another method of image transfer is through the use of a small camera at one end of the tube and a monitor at the other end. Lenses can also be used to convey the image to the observer through an eyepiece.
- Due to the variety of needs created by industry, there are several types of borescopes.

- The basic categories are rigid or flexible
- The borescopes most commonly used today are: fiber optic borescopes, camera borescopes, lens borescopes and micro-borescopes.
- The fiber optic and camera variety are usually of the flexible type, while the lens borescope is typically rigid.
- Borescopes are commonly used for the inspection of objects that have areas of inaccessibility.
- They are preferred in the mechanical engineering field more than any other area and are instrumental in the inspection and condition assessment of engines and engine parts.

Endoscope

- It is bit superior than borescope
- Magnification factor of 10X is obtained
- Available up to smaller dia of 1.7 mm and length upto 100-150mm



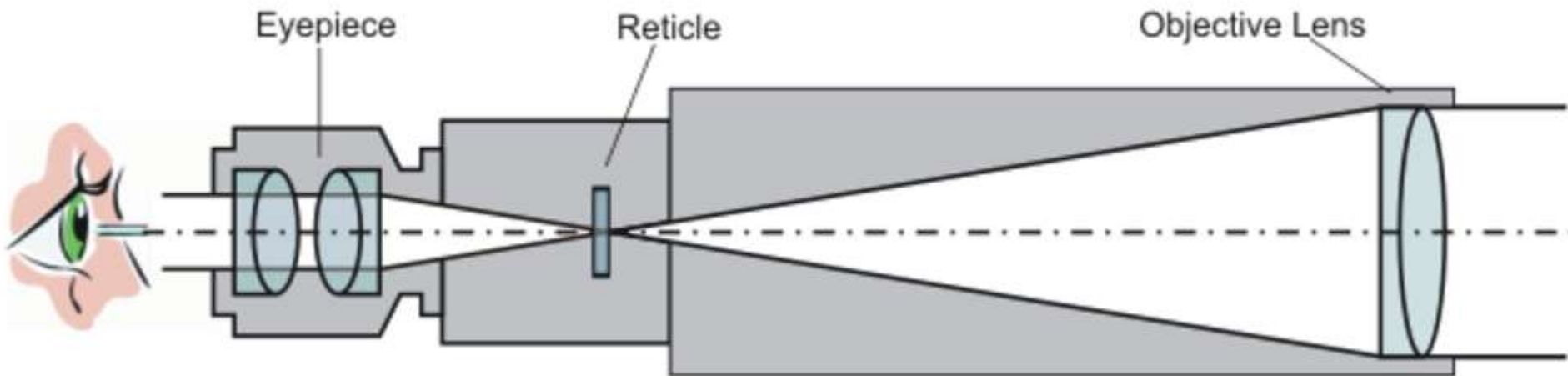


Fibrosopes

- Also called fibre optic borescope
- Dia range of about 3 to 12.5mm and length varies between 60 – 365 cm



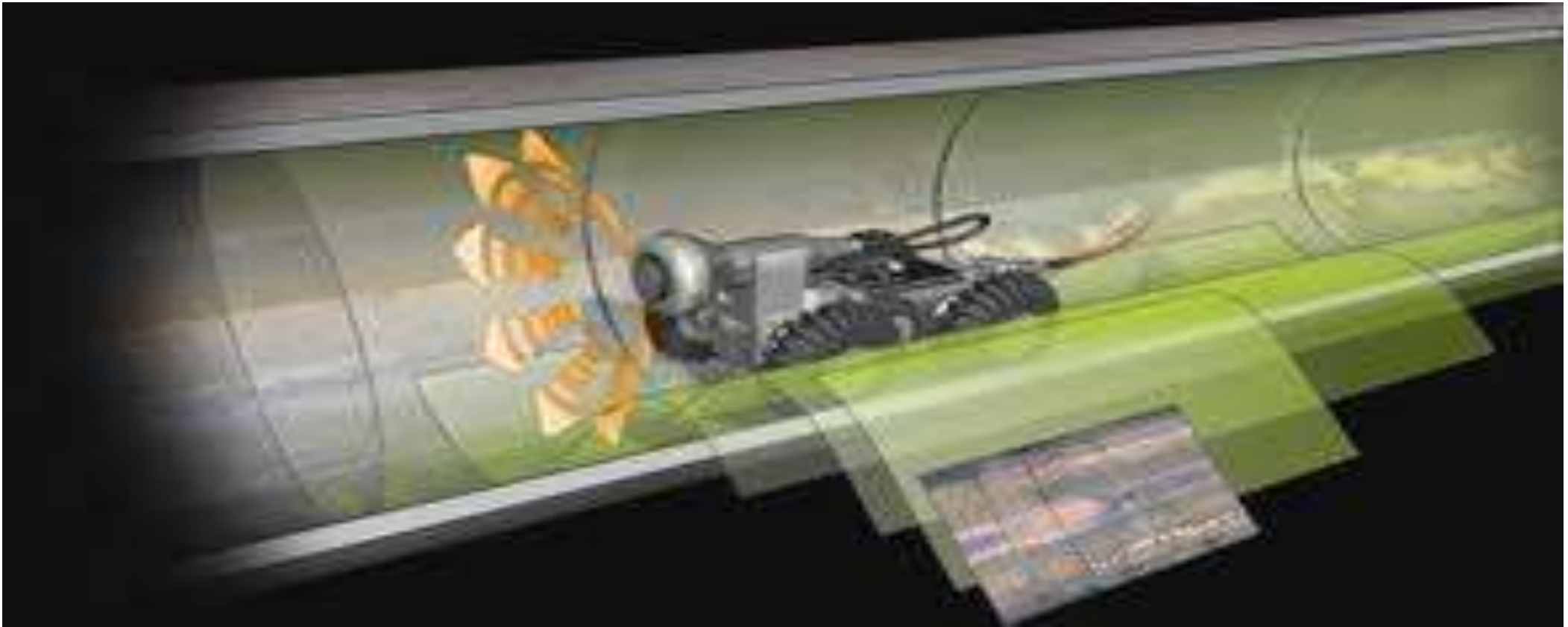
TELESCOPE



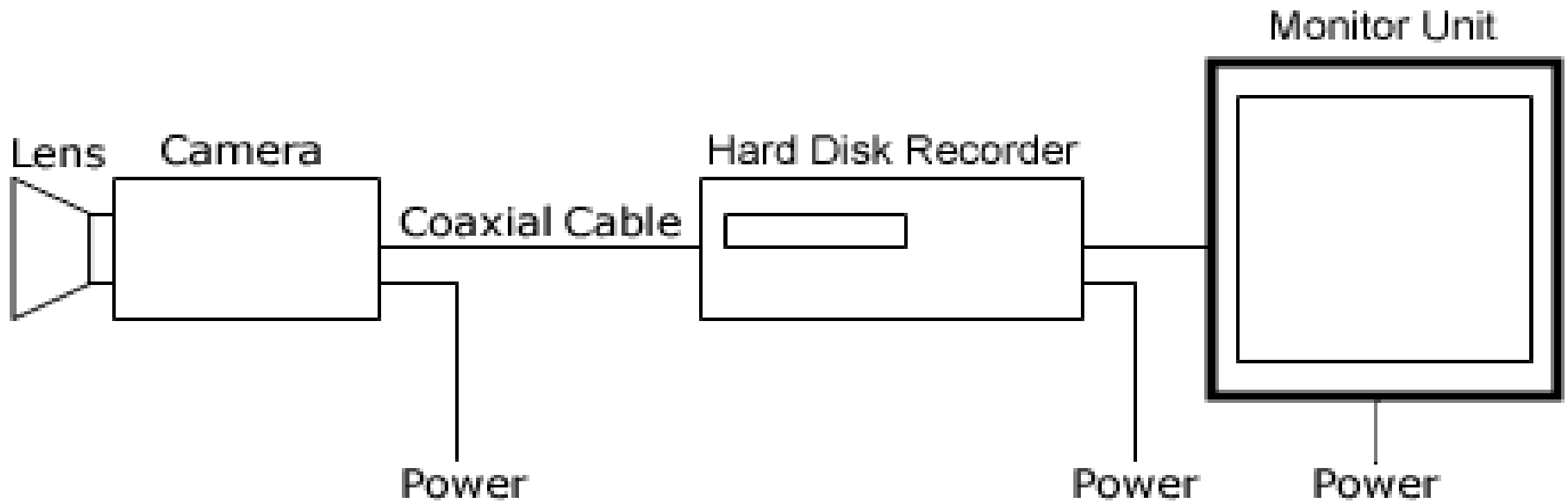
TELESCOPES

- Telescopes are generally understood to be optical instruments for viewing distant objects, as expressed by the Greek words tele (far) and skopein (to view).
- Two lens objective and eyepiece
- Most of the telescopes you see today come in one of two flavors:
 - The refractor telescope, which uses glass lenses.
 - The reflector telescope, which uses mirrors instead of the lenses.

CCTV



cctv



Special Lighting

- Back Lighting
- Front Lighting
- Structured Lighting
- Strobe Lighting
- Ultraviolet Lighting

Computer Enhanced Visual System

