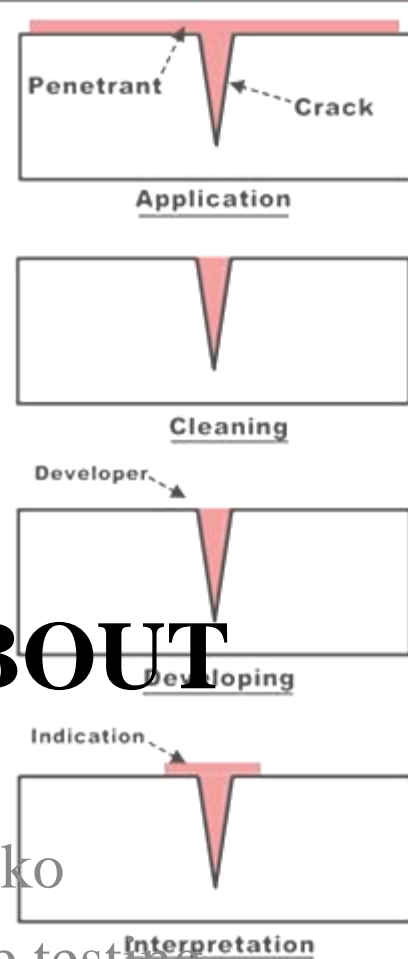


PART 2

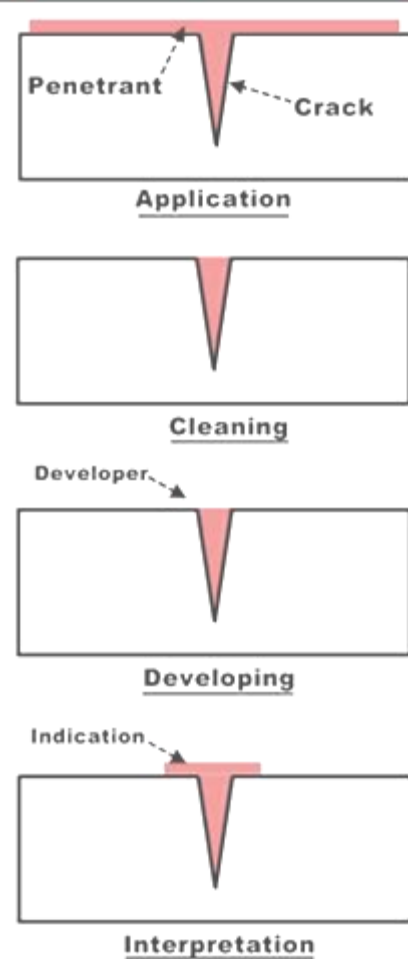
PENETRANT TESTING IS ABOUT

Associate Professor: Nikolay P. Kalinichenko
Department: Physical methods of Nondestructive testing
Institute of Nondestructive testing



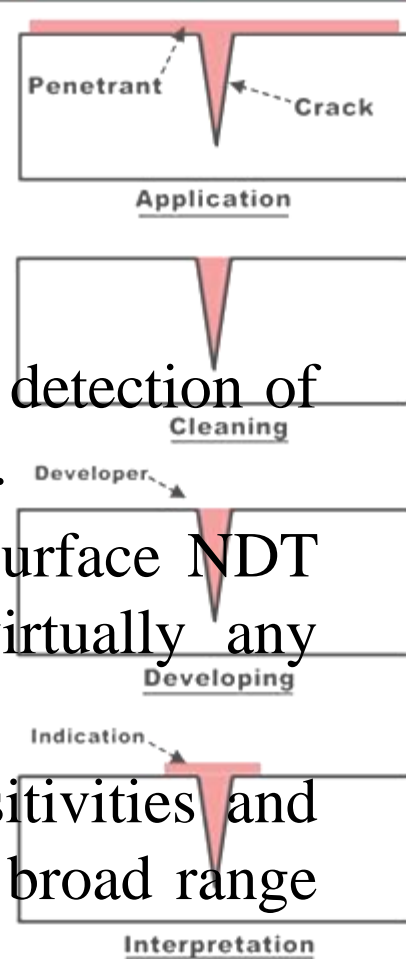
Content:

1. Introduction
2. Vocabulary of Penetrant testing (PT)
3. History and Development
4. Advantage and disadvantage of PT
5. Feedback



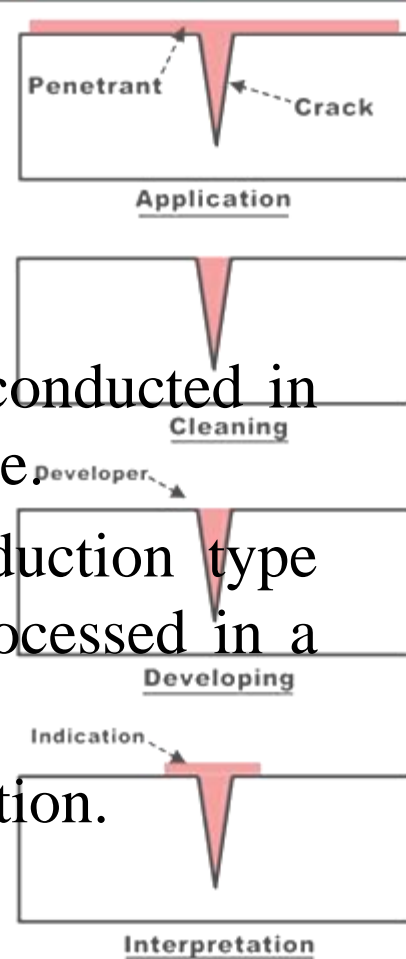
1. Introduction

- PT is one of most widely used NDT methods for detection of surface discontinuities in nonporous solid material.
- It is almost certainly the most commonly used surface NDT method today because it can be applied to virtually any magnetic or nonmagnetic material.
- PT provides industry with a wide range of sensitivities and techniques that make it especially adaptable to a broad range of sizes and shapes.



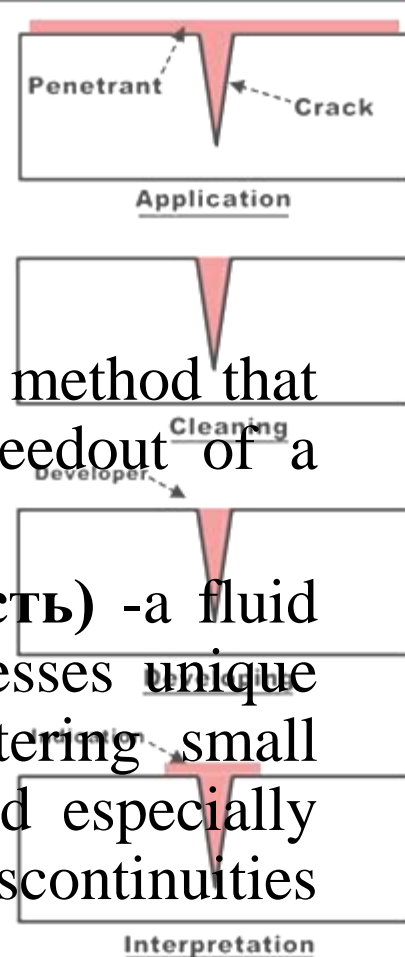
1. Introduction

- It is extremely useful for examinations that are conducted in remote field locations, since it is extremely portable.
- This method is also very appropriate in a production type environment where many smaller parts can be processed in a relatively short period of time.
- This method has numerous advantages and limitations.



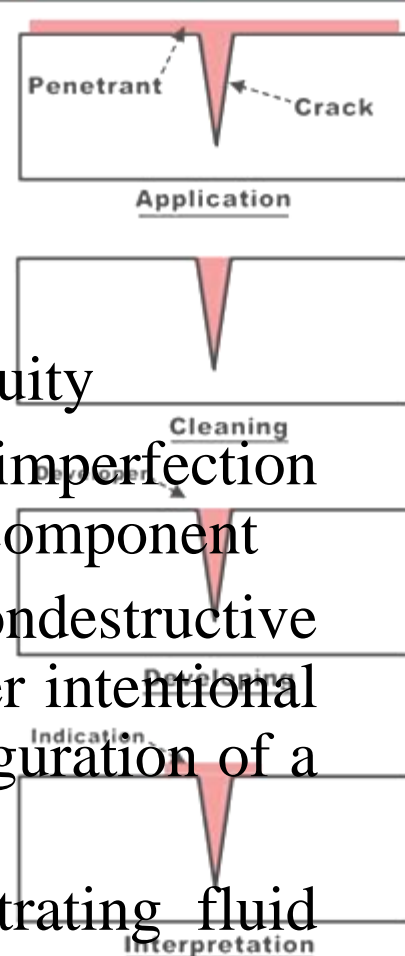
2. Vocabulary

- **Penetrant Testing (капиллярный контроль)** - method that is used to reveal surface breaking flaws by bleedout of a colored or fluorescent dye from the flaw.
- **Penetrant (пенетрант, проникающая жидкость)** - a fluid (usually a liquid but can be a gas) which possesses unique properties that render it highly capable of entering small openings, a characteristic which makes this fluid especially suitable for use in the detection of surface discontinuities which may be present.
- **Artificial discontinuity (искусственная несплошность)** - a feature, such as a notch, hole or crack, that is manufactured to closely resemble a natural defect



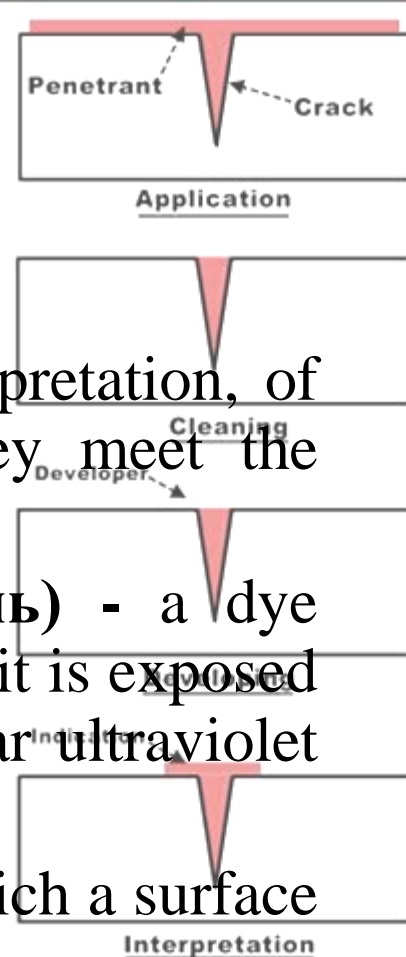
2. Vocabulary

- **Crack, flaw (трещина)** - a long narrow discontinuity
- **Defect (дефект)** - a discontinuity or other imperfection causing a reduction in the quality of a material or component
- **Discontinuity (несплошность)** - in nondestructive examinations, an interruption, which may be either intentional or unintentional, in the physical structure or configuration of a part
- **Dye solution (красящее вещество)**- a penetrating fluid containing a dye which is visible under normal light
- **Developer (проявитель)** – a material that is applied to the test surface to accelerate bleedout and to enhance the contrast of indications



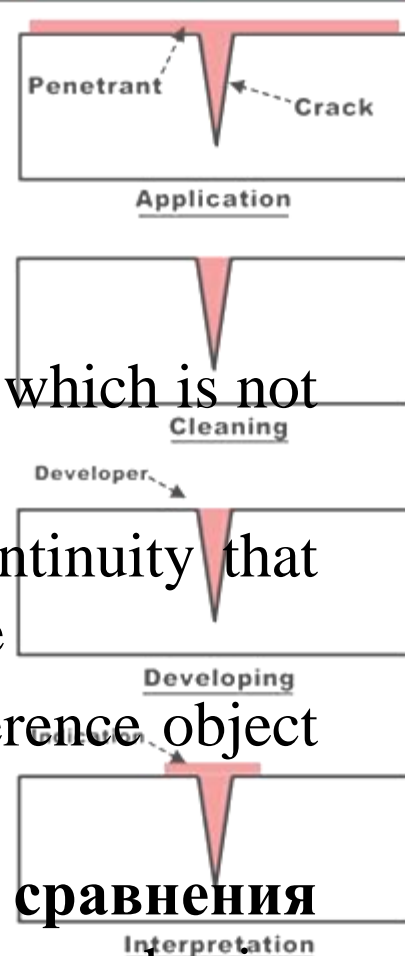
2. Vocabulary

- **Evaluation (оценка)** - a review, following interpretation, of the indications noted to determine whether they meet the specified acceptance criteria
- **Fluorescent dye (флуоресцентный краситель)** - a dye which becomes fluorescent giving off light, when it is exposed to short wave radiation such as ultraviolet or near ultraviolet light
- **Illumination (освещенность)** - the extent to which a surface is illuminated; the provision of light
- **Family (набор дефектоскопических материалов)** – a complete series of penetrant materials required for the performance of a penetrant examination



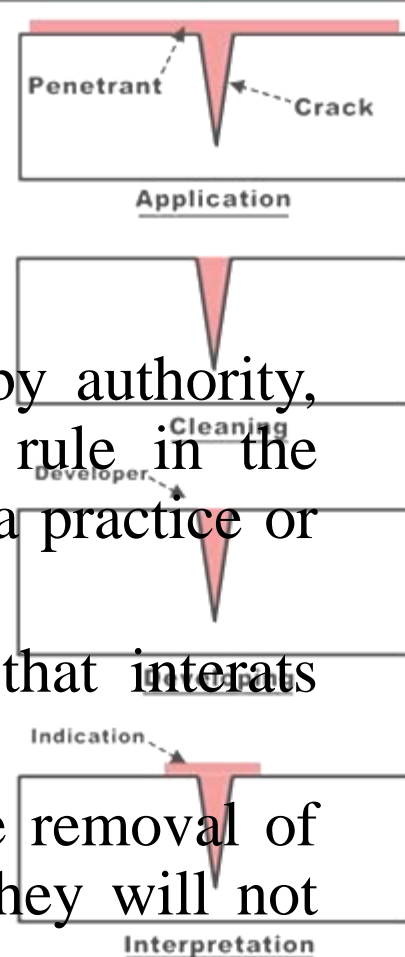
2. Vocabulary

- **Imperfection (дефект, недостаток)** - something which is not completely correct or perfect
- **Indication (индикация)** - evidence of a discontinuity that requires interpretation to determine its significance
- **Check sample (контрольный образец)** - a reference object used as a basis for comparison or calibration
- **Penetrant comparator block (блок для сравнения пенетрантов)** – an intentionally flawed specimen having separate but adjacent areas for the application of different penetrant materials so that a direct comparison of their relative effectiveness can be obtained



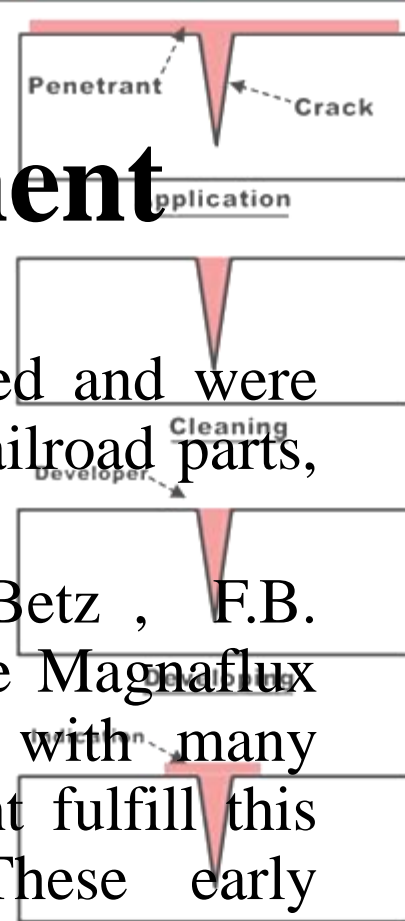
2. Vocabulary

- **Standard (стандарт)** - a concept established by authority, custom or agreement to serve as a model or rule in the measurement of quantity or the establishment of a practice or procedure
- **Emulsifier, remover (очиститель)** – a liquid that interacts with an oily substance to make it water-removable
- **Precleaning (предварительная очистка)** – the removal of surface contaminants from the test part so that they will not interfere with the examination process
- **Postcleaning (окончательная очистка)** - the removal of residual penetrant test materials from the test part after the penetrant test has been completed



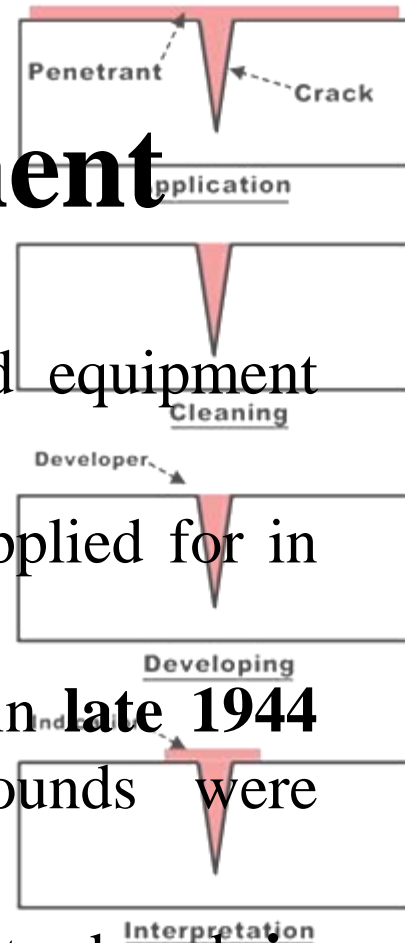
3. History and development

- **Late 19th century** - earliest test were performed and were primarily limited to the examination of various railroad parts, such as axles and shafts.
- **Early 20th century** – the early pioneers Carl Betz , F.B. Doane, and Taber deForest, who worked for the Magnaflux Corporation at the time, were experimenting with many different types of liquids and solvents that might fulfill this need for surface discontinuity detection. These early techniques that were tried brittle lacquer, electrolysis, anodizing, etching, and various color-contrast penetrants. During this period, the anodizing proces was used for detecting cracks in critical aluminium parts, generally associated with aircraft.



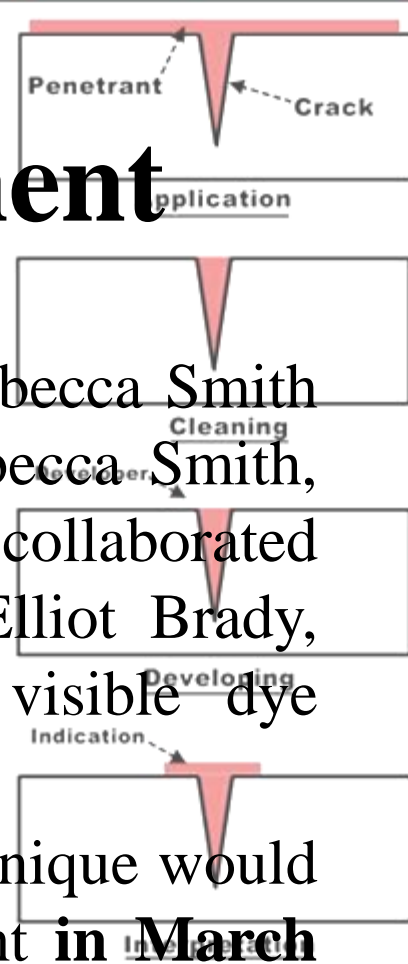
3. History and development

- Water – rinsable penetrant materials are related equipment were first offered around **June of 1942**
- Patent on the “water-washable” technique was applied for in **June of 1942** and was issued in **July 1945**
- The wet developer technique began to be used in **late 1944 and early 1945**. The early developer compounds were yellowish materials consisting mainly of talc.
- The 1st postemulsification penetrants were introduced in **1953**.



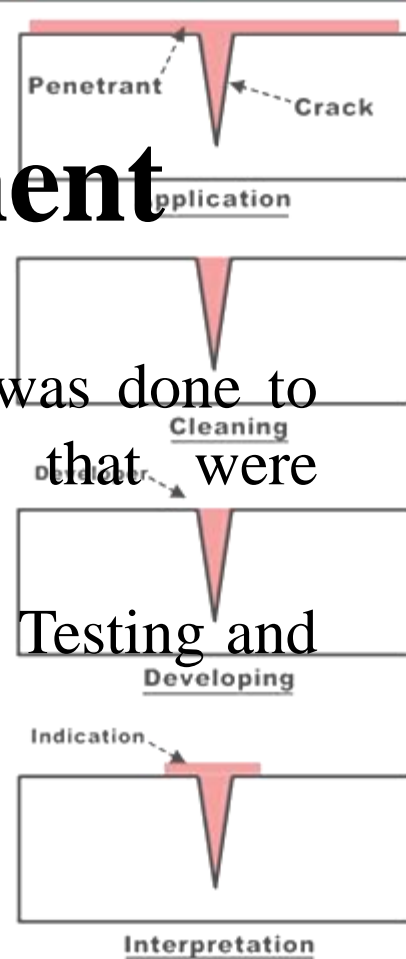
3. History and development

- **In the 1940s**, a Northrop metallurgist named Rebecca Smith developed a visible dye penetrant approach. Rebecca Smith, who would be later known as Becky Starling, collaborated with Northrop chemists Lloyd Stockman and Elliot Brady, who also assisted in the development of a visible dye penetrant.
- The development of the visible dye penetrant technique would take several years; Stockman applied for a patent **in March 1949**



3. History and development

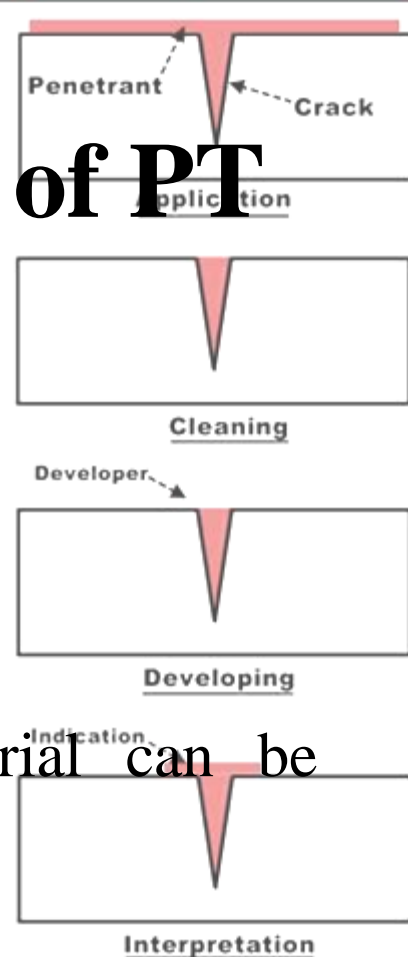
- In the **late 1950s** and **early 1960s**, much work was done to quantify and analyze the various penetrants that were available.
- **The 1950s** - developed the American Society for Testing and Materials (ASTM)



4. Advantage and limitations of PT

The major advantages of penetrant testing include:

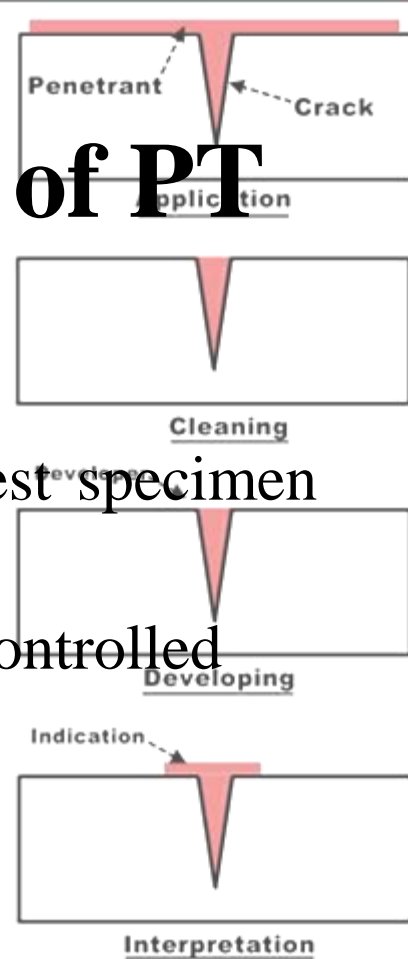
- Portability
- Cost (inexpensive)
- Sensitivity
- Versatile—virtually any solid nonporous material can be inspected
- Effective for production inspection



4. Advantage and limitations of PT

The limitations include:

- Only discontinuities open to the surface of the test specimen can be detected
- There are many processing variables that must be controlled
- Temperature variation effects
- Surface condition and configuration
- Surface preparation is necessary
- The process is usually messy



PART 2

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