Instruction manual

D20-1278-W0

Light Interference Plates IP-5N

November 2023

Product's Feature

This product (Light Interference Plates IP-5N) includes optical flat glass plates specially designed for observing and counting a pattern of interference fringes visible as light and dark bands.

[Overall Advantages to Users]

Each of the glass plates has the flatness high enough to form a series of alternating/contrasting interference fringes visible as dark and light bands with equal spacing.
Another advantage of the glass plate is its sufficient size (50 x 200 mm) that helps a user easily calculate the thickness of a thin material such as a cellophane film or a human hair based on the number of fringes counted and a known frequency of a monochromatic light source (like a sodium lamp).

[Keywords]

*Interference fringes	*Interference of light	*Reflection and Refraction
*Light wavelength	*Monochromatic light source	

Specification

- Optical flat glass plate: 2 pcs, 50 x 200 x 6 mm
- Rubber band: 2 pcs
- Thin paper: 2 pieces
- Plastic film: 2 pieces
- Storage box: 1 pc

Safety Precautions

✓ Wear dark glasses to protect your eyes when a light source is in use. If a mercury lamp is in use, wear UV-cut dark glasses.

✓ Be careful when handling the glass plate due to its fragility.

✓ Keep the surface of the glass plate clean for better observation of a pattern of interference fringes. When noticing adhering substance on the glass plate, wash the glass plate with neutral detergent and dry it.

✓ Do not polish the glass plates with abrasive. The surface may be easily damaged.

How to use

1. How to observe a pattern of interference fringes:

1. Place a sheet of black paper larger than the glass plate on the table.
2. Stack the two glass plates with no misalignment (exactly on each other) and place them on the black paper.
3. Set up a sodium lamp so that its illumination will reflect off the ceiling on the glass plate.
4. Turn on the sodium lamp and turn off the room lighting.
5. Observe the pattern of interference fringes visible as dark and light bands on the upper glass plate.

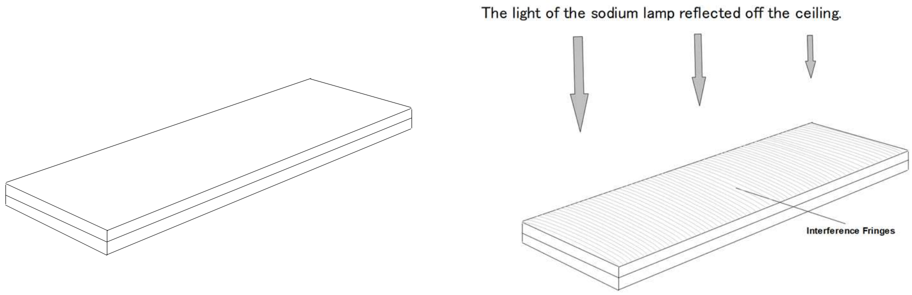

Fig. 1 Observing a pattern of interference fringes with equal spacing.

Note: The pattern of interference fringes can be partly and easily distorted in case some liquid and/or dust stay on the glass plate during experiment.

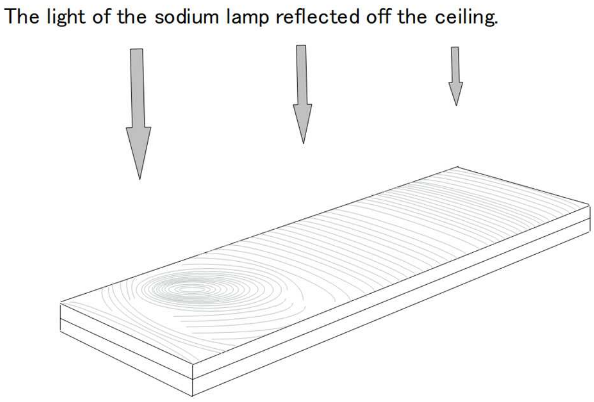

Fig. 2 Example of a distorted pattern of interference fringes.

2. How to measure the thickness of a thin plastic film

1. How to count the number of interference fringes in a given area visible as light and dark bands.

(1) Stack the two glass plates with no misalignment (exactly on each other), and then fasten a rubber band around the end point A (Fig. 3).

(2) Insert a plastic film between the glass plates from the other end point B, and then fasten a rubber band around the end point C (Fig. 3).
(3) Prepare a strip of black paper size 2.0 cm in width and over 5 cm in length as well as a piece of white paper (A4 size) respectively.
(4) Place the white paper on a table, and then stack the strip of black paper on the white paper (Fig. 3).
(5) Place the stacked glass plates to intersect the strip of black paper at a right angle (90 degrees).
(6) Set up a sodium lamp so that its illumination will reflect off the ceiling on the glass plate.
(7) Turn on the sodium lamp and turn off the room lighting.
(8) Observe the pattern of interference fringes visible as dark and light bands on the area of the glass plate overlaying the strip of black paper.

2. How to obtain the interval (spacing) between one of the dark bands and the adjacent light one.

(1) Measure the length (L) between point A to point B of the glass plate.
(2) Count the number of light or dark bands visible within the rectangle area over the black strip paper (2.0 cm in width) by observing the glass plates from straight above.
Note: The black strip paper under the glass plates will make the light bands stand out from the dark ones by creating more contrast.
(3) Obtain the interval of interference fringes (l) by assigning the value N into the equation below.

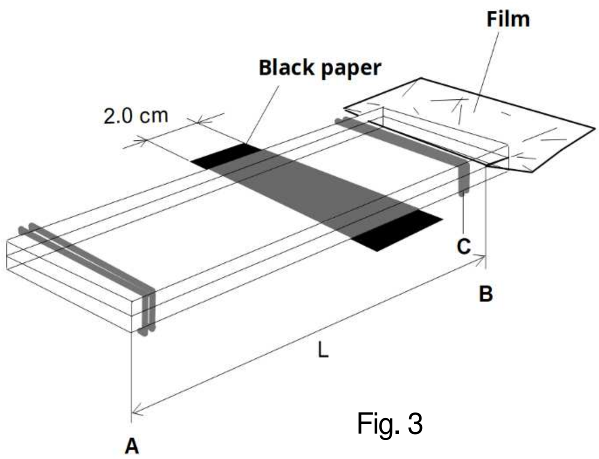

Fig. 3

N: Number of the light bands counted within the black strip paper (2.0 cm in width).
l: Interval of the interference fringe (m)

$$l = \frac{2.0\ x\ 10^{-2}\ (m)}{N}$$

3. How to obtain the thickness of the thin plastic film.

Obtain the thickness of the thin film (t) by assigning the values L, l, and λ (frequency of Sodium light) into the equation below. Sodium Lamp is a monochromatic light source with a single frequency (5.9 x 10^{-7} m).

$$t = \frac{L\,\lambda}{2\,l}$$

3. Determining the frequency of unknown monochromatic light

Keep the pair of the stacked glass plates with the thin plastic film in between, as is, so that you may move onto the next experiment under the same conditions.

1. Set up a light source with unknown wavelength so that its illumination will reflect off the ceiling.

2. Turn on the lamp and turn off the room lighting.

3. Count the number of the light bands in the rectangle area over the black strip paper to obtain the interval of interference fringes (l) based on the above equation (see 2. How to measure the thickness of the thin plastic film).

3. Obtain the light wave frequency of the lamp being used by assigning the values of l, L, and t into the equation below.

$$\lambda = \frac{2lt}{L}$$

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