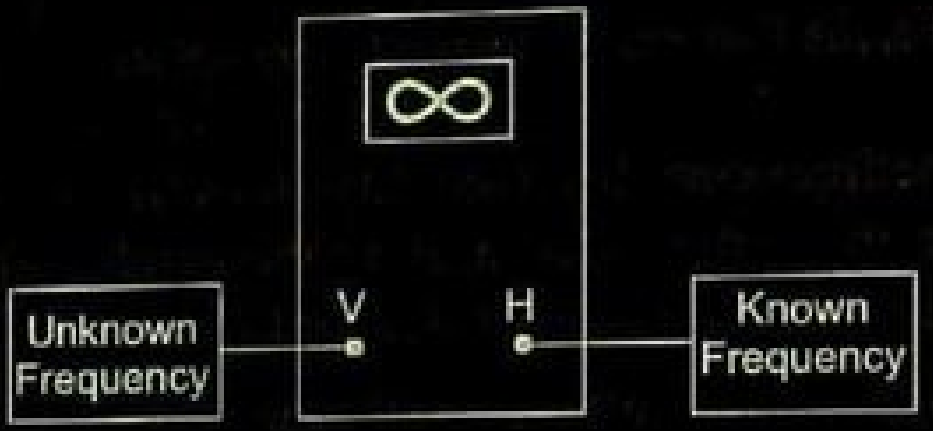
Measurement of Frequency by Lissajous method

- The Oscilloscope is a Sensitive indicator for Frequency and Phase Measurements.
- The Lissajous Pattern Results ,when sine waves are applied simultaneously to both pairs of deflection plates.
    - If One frequency is an integral multiple of other ,the pattern will be stationary and is called a Lissajous figure.

Measurement of Frequency by Lissajous method



Basic Circuit for Frequency Measurements with Lissajous Figures

- The Resulting Patterns depend on the integral and phase relationship between two frequencies.

Measurement of Frequency by Lissajous method

➢ Measurement Procedure

1. Set up the Oscilloscope and Switch off the Internal sweep(Change to Ext)
2. Switch off Sync. Control
3. Connect the Signal sources as shown in above fig.
4. Set the Horizontal and Vertical gain Control for desired width and height of the Pattern
5. Keep freq f_v Constant and Vary freq f_h noting that the pattern spins in alternate directions and changes shape.
6. The Pattern stands still when ever f_v and f_h are in an integral ratio(either even or odd)
7. When $f_v=f_h$, the pattern stand still and is a single circle or ellipse
8. When $f_v=2f_h$,a two loop horizontal pattern is obtained.

Measurement of Frequency by Lissajous method

$$f_v = (\text{fraction}) \times f_h$$

$$\text{or } \frac{f_v}{f_h} = \frac{\text{number of horizontal tangencies}}{\text{number of vertical tangencies}}$$

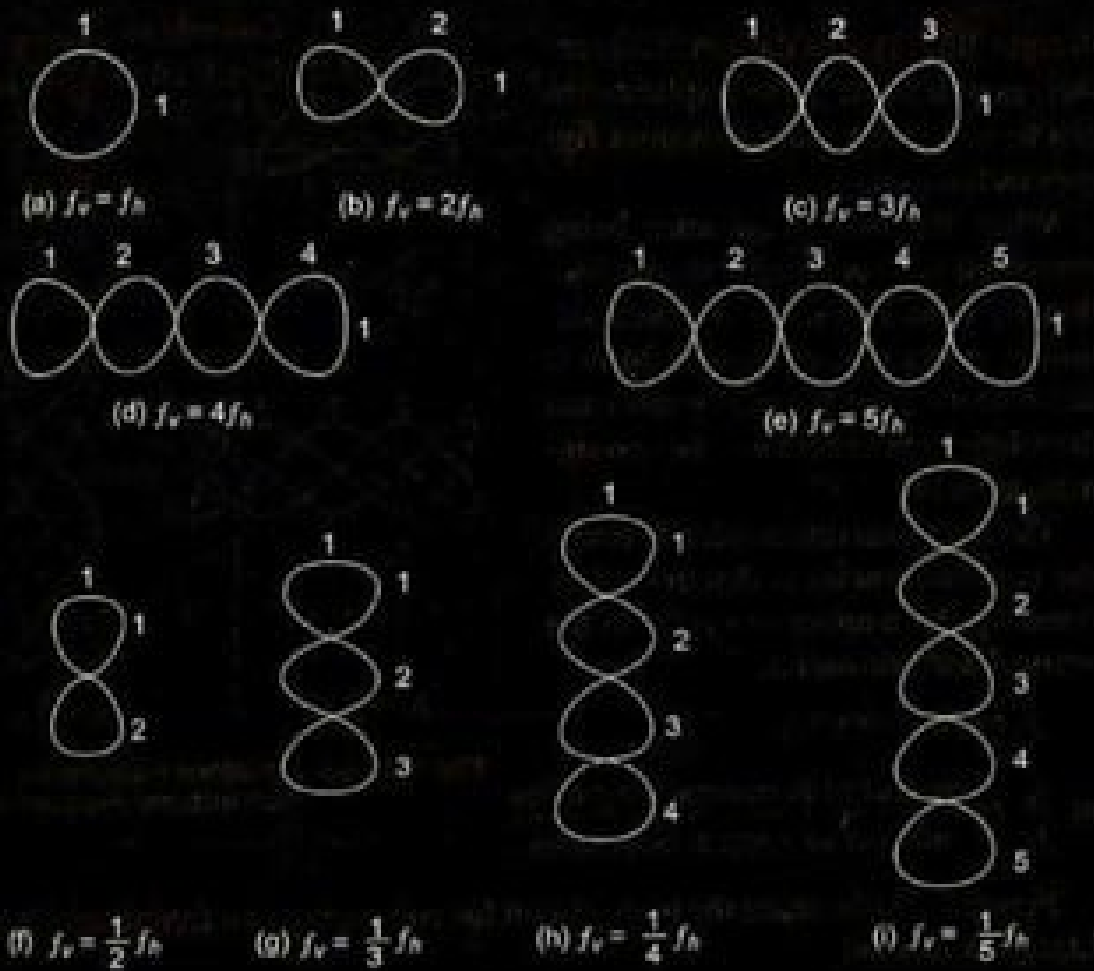
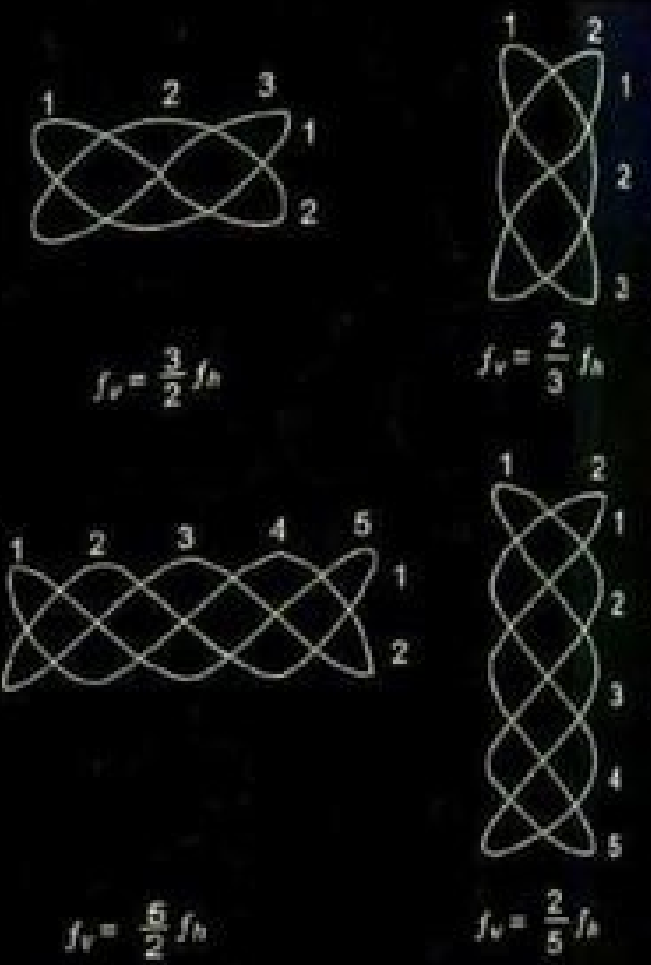


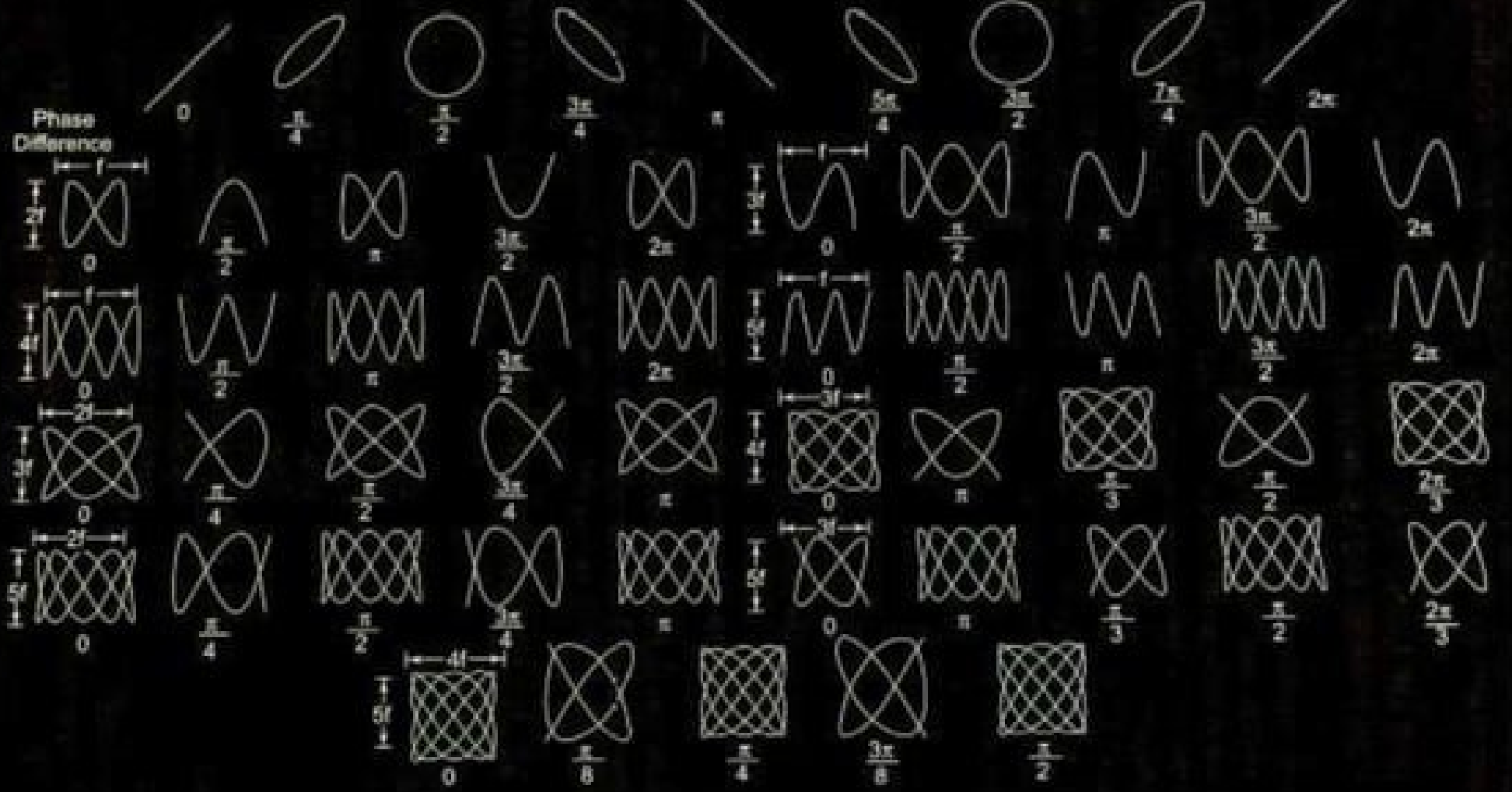
Fig. 7.31 — Lissajous Patterns for Integral Frequencies

Measurement of Frequency by Lissajous method

When the two frequencies being compared are not equal, but are fractionally related, a more complex stationary pattern results, whose form is dependent on the frequency ratio and the relative phase between the two signals, as in Fig.



Lissajous Patterns for Non-Integral Frequencies


Phase Difference
0
π/4
π/2
3π/4
π
5π/4
3π/2
7π/4
2π