



## Magnetic Rollers Apparatus

11065.00

### Operating Instructions



Fig. 1: Magnetic Rollers Apparatus set up for an experiment demonstrating „longitudinal waves“.

#### 1 PURPOSE

Model experiments showing the propagation of longitudinal waves and the characteristics of elastic collisions can be carried out with the device.

#### 2 DESCRIPTION

The device consists of 12 rollers and a 1m long, U-shaped track which has division markings on each side.

Each magnetic roller consists of a cylindrical magnet ( $d=28\text{mm}$ ,  $l=6\text{mm}$ ), magnetised in the axial direction, enclosed in plastic with roller rims and coloured pole identification. End bolts on the track prevent the rollers running off.

#### 3 OPERATION

- **General construction:** The track is set up level and clamped in two holders which are in turn supported by barrel bases. The rollers are arranged on the track such that their magnetic moments are orientated in the same direction (repulsion).

- **Magnetic „walls“:** Magnetic walls provide an elastic reflection of approaching rollers.

To form a magnetic wall at the end of the track, just place a roller adjacent to the end bolt.

For a magnetic wall in the centre of the track: Place two rollers with antiparallel magnetic moments next to one another or position the track between the legs of a powerful horseshoe magnet.

- **Setting a roller in motion:** This can be easily done manually, but the rollers should be rolled rather than pushed to reduce wear on the rolling rims.

Other methods of setting in motion: Bring a horseshoe magnet in the vicinity of the roller to be started or bring a second roller near a roller which is held, for example at the end of the track and then released.

**Important:** To avoid reducing the magnetic strength of the rollers, they should not be allowed to fall from bench height onto a hard floor.

#### 4 EXPERIMENTAL EXAMPLES

- **Longitudinal waves:** To demonstrate this, all the rollers are distributed equidistantly along the track with a roller at each end of the track. When a roller is set in motion, a propagated wave can be observed in the disturbance of the rollers with the wave being reflected at the end rollers. Although the wave is damped, up to three oscillating runs can be observed.

- **Elastic collision against a wall:** Multiple reflections can be observed within a shortened roller track bounded by two magnetic walls.

- **Central elastic collision:** A roller which is set in motion collides with a stationary one; the interchange of momentum can be observed.

- **Impact propagation:** A roller which is set in motion collides with a chain of 3-5 stationary rollers separated from one another by a distance of 10-15cm. The impact is propagated in the chain and the last roller moves away from the chain.

#### 5 EXPERIMENT LITERATURE

Physik in Demonstrationsversuchen,  
Ausgabe A/B, Mechanik

01141.21

#### 6 LIST OF EQUIPMENT

Magnetic Rollers Apparatus	11065.00
Plate holder	(2x) 06509.00
Barrel Base PASS	(2x) 02006.55
Magnet, large, horseshoe (suitable for „magnetic wall“)	06320.00
Magnetic Roller, replacement	11065.01