1214007

Ripple Tank:

Instruction Manual

The Ripple Tank comprises the following individual parts:

Water Tank.................................1pcs

Detachable legs..............................3pcs

Angular holders..............................2pcs

Plate fitting..................................1pcs
Fixing rods for Strobe-unit and vibration Generator....................................2pcs

Mirror..1pcs

Frosted glass plate............................1pcs

Strobe-unit....................................1pcs

Vibration-Generator..........................1pcs

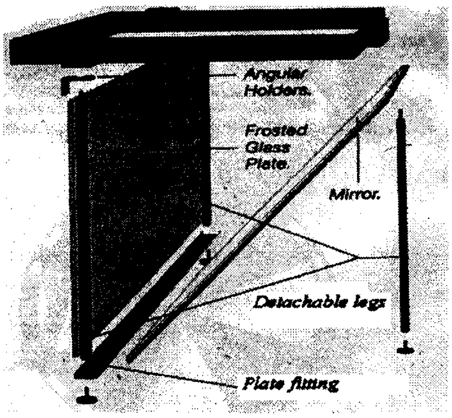
Frequency Controlling-Unit............1pcs
Single dipper..................................1pcs
Double dipper.................................1pcs
Triple dipper..................................1pcs
Dipper for parallel waves..................1pcs

Acrylic block, concave 1pcs
Acrylic block, rectangle.....................1pcs
Acrylic block, semi-circle...................1pcs
Connection wire for Strobe–Unit...........1pcs
Connection wire for Vibration-Generator..1pcs
Transparent Ruler for measuring...........1pcs
Pipette flask with special solvent..........1pcs

Required additional equipment:

Power Supply : 10-15V DC/1.5-2A

Assembly of the ripple tank:



RT-1

Users can assemble the ripple rank according to the figure RT-1.

Attach the 3 detachable legs to the ripple tank.

The 2 angular holders must be inserted in between the fixtures and the 2 front legs. Likewise the plate holder is inserted between the leg and the leveling feet of the 2 front legs. The plate holders' oblique edge must point backwards towards the third leg.

The strobe-unit should be placed with the display facing you when viewed from the front. The frosted glass plate and the mirror slides is to be placed under the tank, the mirror in an oblique position.

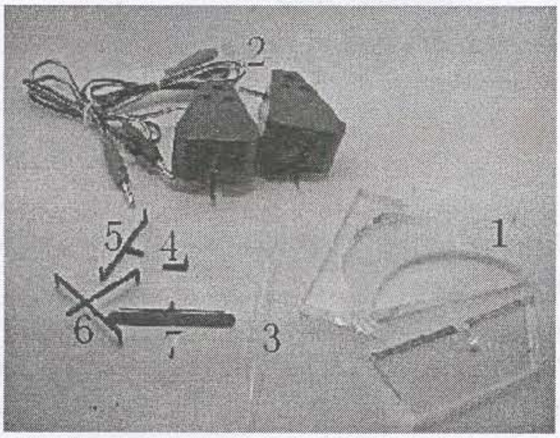
Adjust the tank to level by means of the leveling feet. If the table top is level it may be sufficient to adjust the third leg, as this leg is slightly shorter than the 2 front legs with the angular holders inserted. A spirit level could come in handy for this job.

Mount the fixing rods for the Vibration-Generaor and Strobe-Unit. Connect the Vibration-Generator and Strobe-Unit to the Controlling-Unit. N.B. always connects the connection wire's red banana plug to the positive terminal.

Connect the Controlling-Unit to an appropriate power supply capable of supplying 10-15V DC/1.5A.

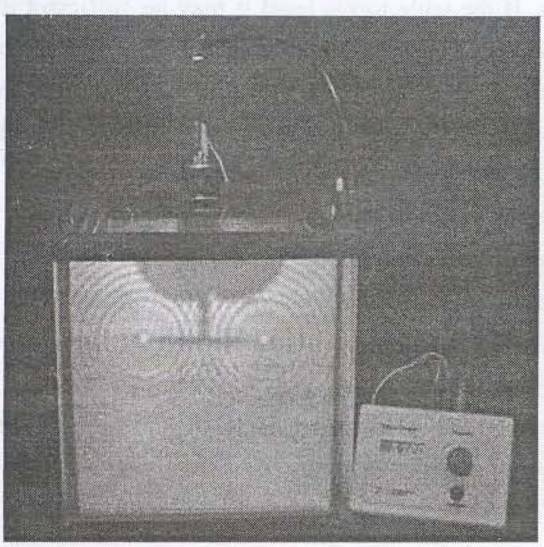
Filling water:

Distilled or demineralized water is recommended in order to avoid problems related to limescale. Filling in approximately 500ml of water. 500ml of water would be suitable i.e. a water depth of approx. 6-7mm. Problems in relation to surface tension is avoided by adding 2-3 drops of the special solvent supplied in the pipette flask. Disperse the solvent along the foam liners on the tank with the finger tip. Likewise it is advisable to apply just a little of this solvent to the dippers before using them.



Accessories

1, Acrylic blocks, 3 types
2, Vibration Generator
3, Dropping Pipette
4, Single dipper
5, Double dipper
6, Triple dipper
7, Dipper for parallel waves



Ripple tank in use

There is a lock on the vibration-generator, it is used for keeping the generator undamaged when transport or change dipper. So the vibration -generator must be locked when you change dipper.

The single dipper:

Utilized for experimental demonstration of the wave formula and the Doppler Effect.

The double dipper:

A good tool to demonstrate interference patterns.

The plane wave dipper:

This dipper may be used for the demonstration of reflection and refraction.

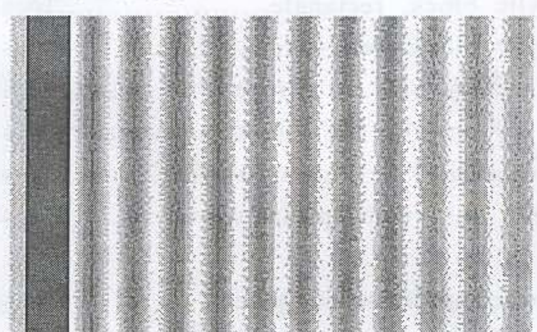
The acrylic blocks:

The acrylic block is a set of 3 transparent blocks used to demonstrate that the velocity of propagation will vary with different depths. Place the block in the tank so that the depth over the block is shallower than the other areas. By letting plane parallel waves pass over different shapes of acrylic blocks, it is possible to demonstrate how the shape of the blocks influence the refraction of the waves. By lowering the water depth, the same blocks can be used to demonstrate reflection.

Demonstrating wave properties:

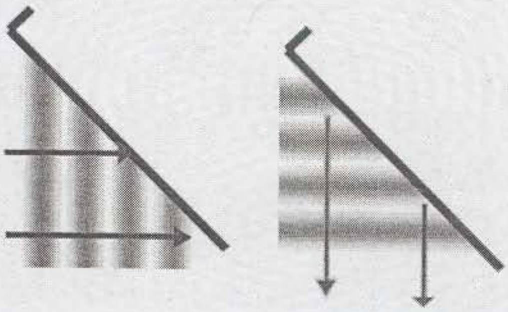
A number of wave properties can be demonstrated with a ripple tank. These include plane waves, reflection, refraction, interference and diffraction.

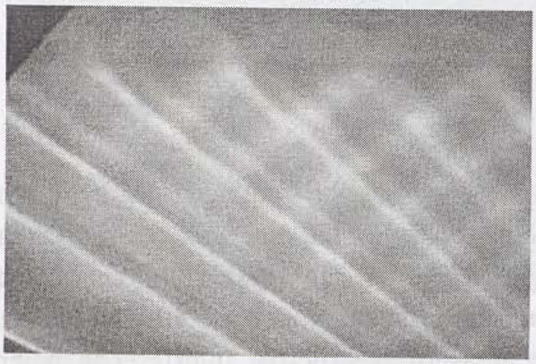
Plane waves:



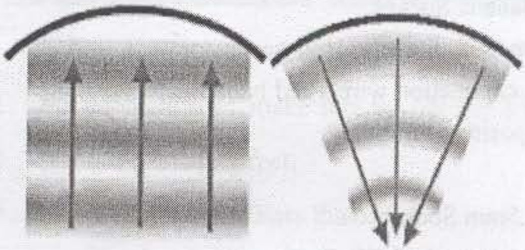
Use the dipper for parallel waves to generate plane waves.

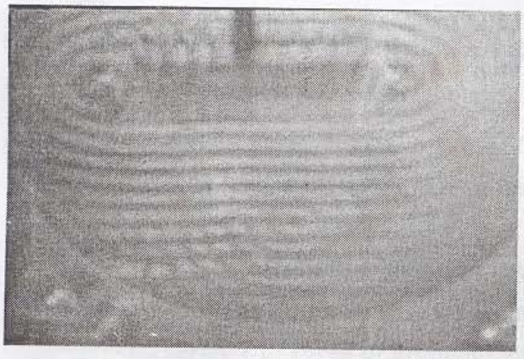
Reflection:





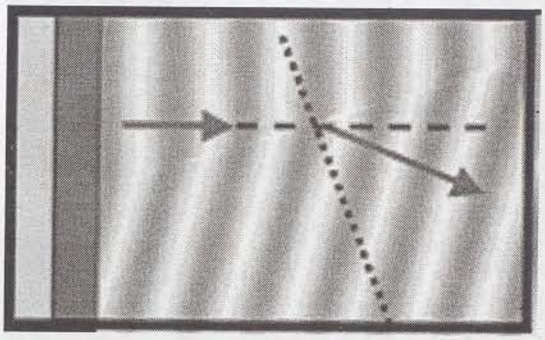
Place a bar in the tank. The ripples will reflect from the bar. If the bar is placed at a angle to the wave front the reflected waves can be seen to obey the law of reflection.





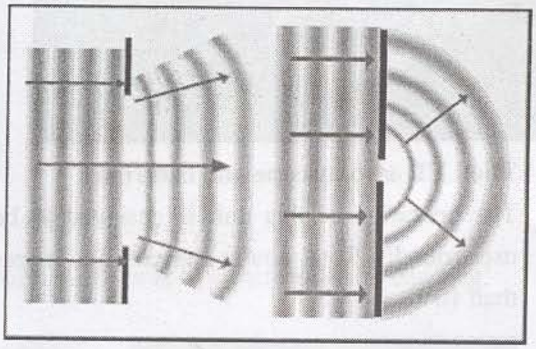
If the concave acrylic block is used, a plane wave will converge on a point after reflection.
This point is the focal point of the mirror. Circular waves can be produced by using the single dipper. If this is done at the focal point of the "mirror", plane waves will be reflected back.

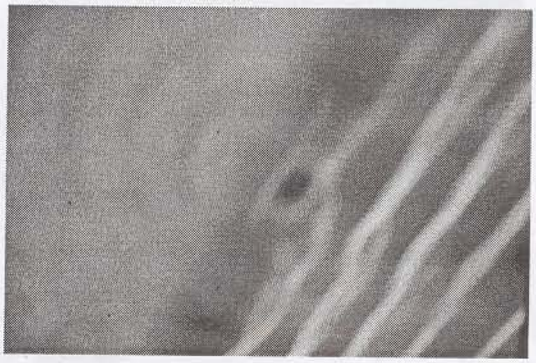
Refraction



If a block is placed in the tank, the depth of water in the tank will be shallower over the block than elsewhere. The speed of a wave in water depends on the depth, so the ripples slow down as they pass over the block. This causes the wavelength to decrease. If the junction between the deep and the shallower water is at an angle to the wave front, the waves will refract.

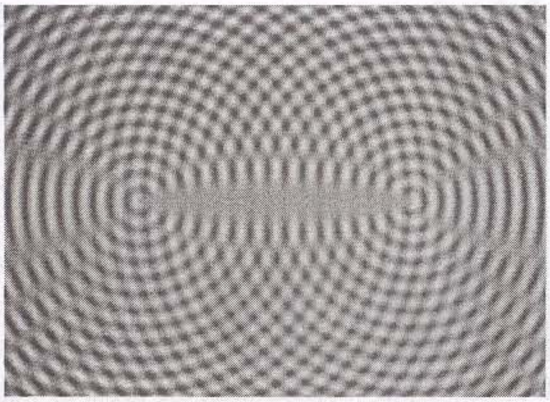
Diffraction

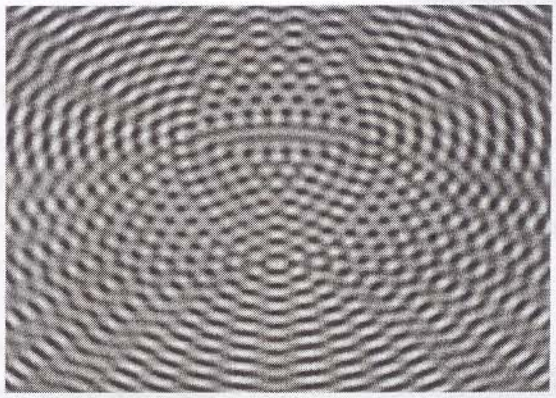




If an obstacle with a small gap is placed in the tank the ripples emerge in an almost semicircular pattern. If the gap is large however, the diffraction is much more limited. *Small*, in this context, means that the size of the obstacle is comparable to the wavelength of the ripples.

Interference

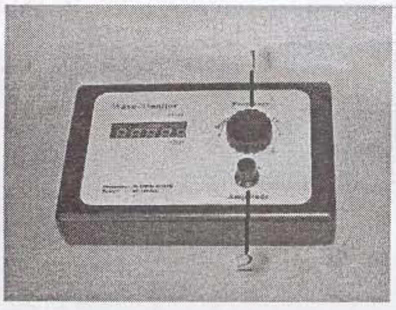




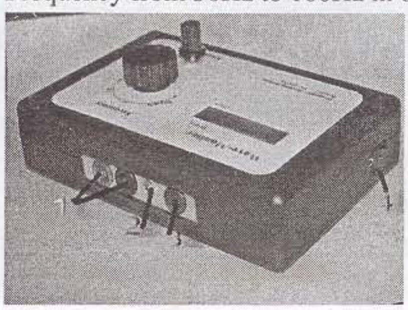
Interference can be produced by using the double dipper. In the diagrams the light areas represent crests of waves, the black areas represent troughs. Notice the grey areas: they are areas of destructive interference where the waves from the two sources cancels out one another.

The LED-stroboscope and controller

The operation of this unit is designed to be user friendly. Total power consumption is less than 10W.



1, Adjust frequency here
2, Adjust amplitude here
Frequency from 30Hz to 100Hz in 0.01 steps



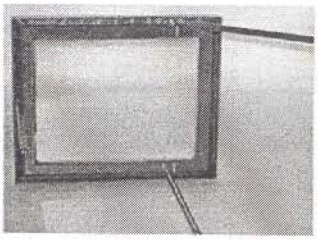
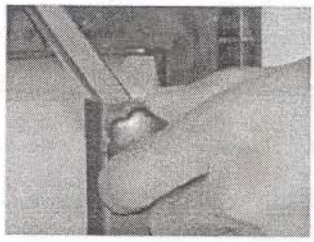
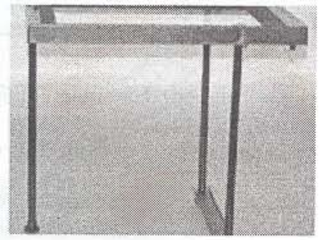
1, Banana Socket
Connect to the vibration-generator
The connection wire's red banana always plug the positive terminal

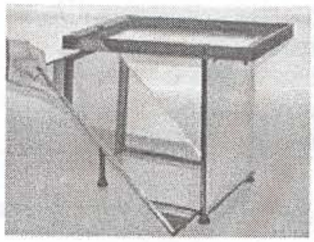
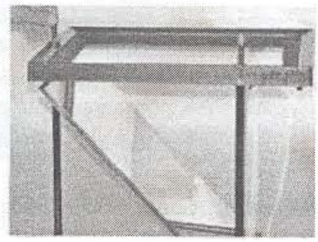
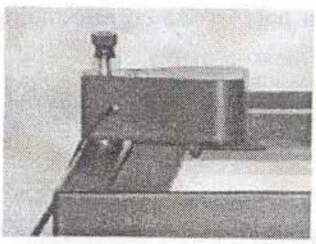
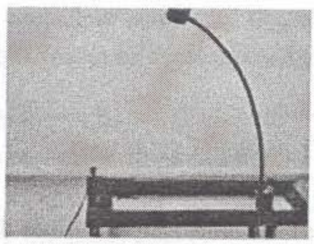
2, 3.5mm Socket
Connect to the LED-Stroboscope
The LED-stroboscope can work safely at 3-6.5V

3, DC Socket
Connect to 10-15V DC/1.5-2A power supply

4, Power switch
To turn on and off

Procedure of assembly

1. Attach the three detachable legs to the tipple tank.
2. Fix the plate hold, make sure the oblique edge must point backwards in direction of the third leg.
3. Insert the leveling feet.
4. Insert the Frosted Glass Plate.
5. Insert the mirror.
6. Mount the fixing rods for the LED-stroboscope and the vibration-generator.
7. Fix the Vibration-Generator and use nut on it to fix the unit.
8. Likewise, fix the LED-stroboscope.

WAVE TABLE EXPERIMENTS

Experimental series 1 of speed of propagation

The purpose of this experiment is to demonstrate the relationship: $v = f \bullet \lambda$ where v is the propagation speed of the wave, f is the frequency and λ is the wavelength.
The water table should be assembled and placed on a white tabletop. The wave generator should be mounted with a plane wave generator (a plane wave dipper) which generators plane, parallel waves.
A row of light and dark stripes will be observed on the table top due to wave peaks and troughs respectively. One wavelength λ is the distance between two light or between two dark stripes. It may be necessary to

regulate the amplitude of the wave generator to obtain reasonably sharp images of the waves on the table. Also, be sure that there are on bubbles or other impurities in the water container or on the wave generator.

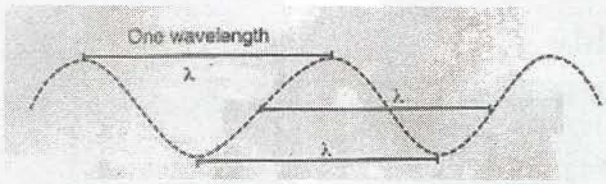
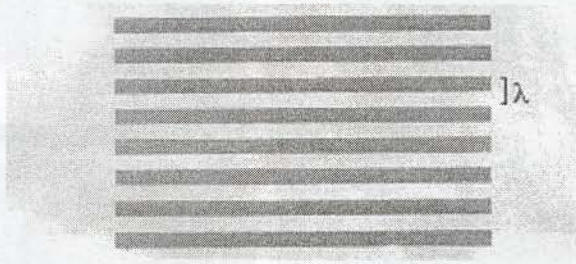


Figure 1: A harmonic wave



The projection of the water waves on the table should look like this (λ is exactly one wave length).

Exercise 1:

Using the ruler on the table to measure the wavelength in metres, and make a note of the corresponding frequency read from the strobe light. Choose another frequency and repeat the measurements of λ and f. make five sets of measurements in all.

Data table:

a) Compute the speed $v = f \bullet \lambda$ for each pair of measurements, and write the result in the last row of the table.

f/Hz					
λ / m					
$v = f \bullet \lambda / (m/s)$					

b) Is the speed reasonably constant?

c) Compute the average value of v.

Exercise 2:

The equation $v = f \bullet \lambda$ can be rewritten as $\lambda = v \bullet f^{-1}$. Thus in a coordinate system with λ plotted as a function of f^{-1} a straight line should result with the speed v as the slope.

f^{-1} / s					
λ / m					

Draw a graph plotting in your data. Is the resulting graph a straight line through the origin (0,0)? Find the slope of the line, and compare it with the average value of v which you found in Exercise 1.