

Ripple Tank Experiment

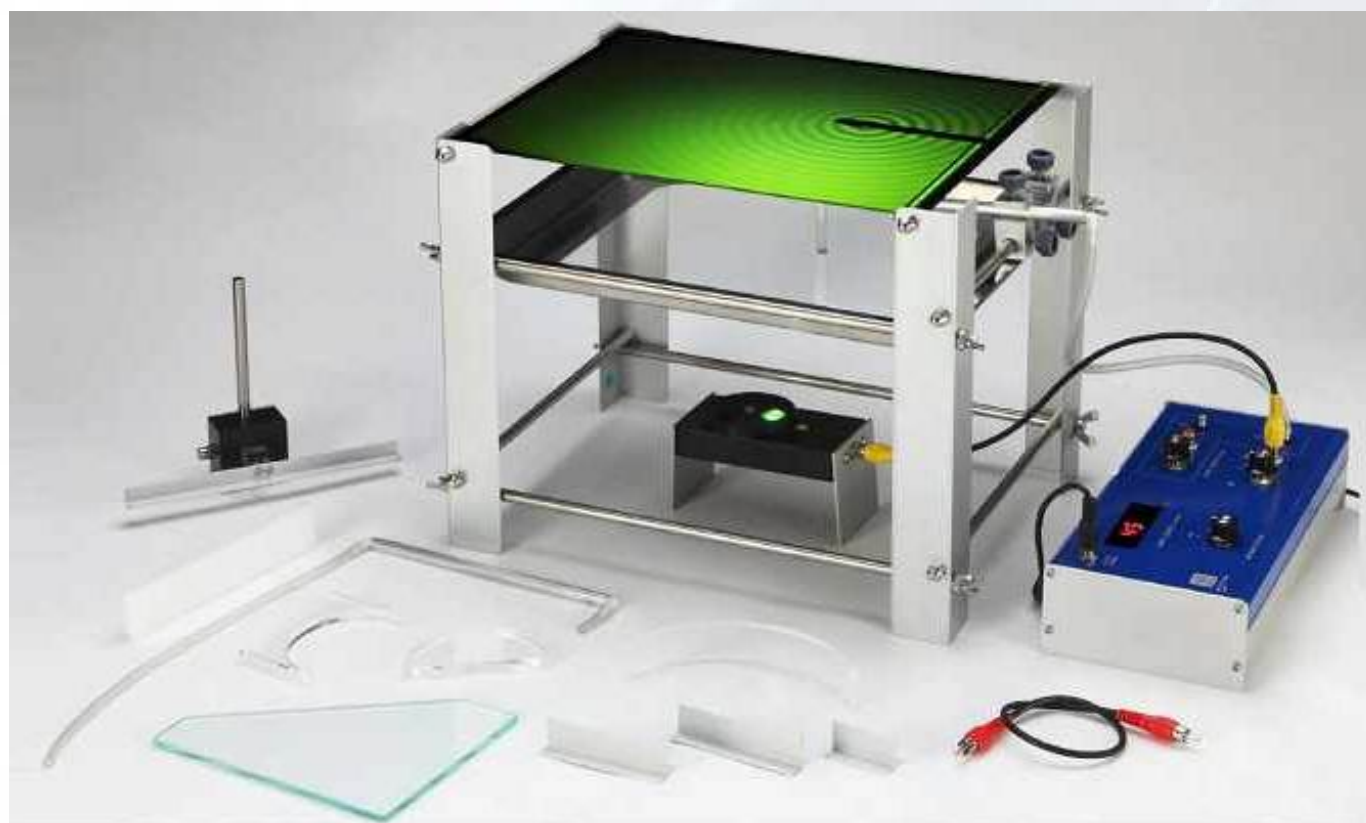
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Contents

Point wave

If you throw a stone into a still pond, it can produce ripples. These ripples will expand from the place where you throw to the side of the pond. Suppose there is just a leaf on the surface, when ripples pass by, it only moves upside down and doesn't proceed with ripples. However, ripples have already transferred part of their energy to this leaf. Similarly, waves on sea are similar to ripples in pond, they also can make ships move upside down.

If contacting the water by a point or a line, you can produce point waves and straight waves.

Wave's reflection

Reflection: If straight waves or circular waves propagating in the water touch the barrier, they will return to the water from the interface and proceed to move on. This phenomenon is called reflection. It will obey reflection law:

1. Incident ray, reflected ray and normal line are on the same plane. In addition, incident ray and reflecting ray are at different sides of the normal line.
2. Incident angle are equal to reflected angle.

Wave's refraction

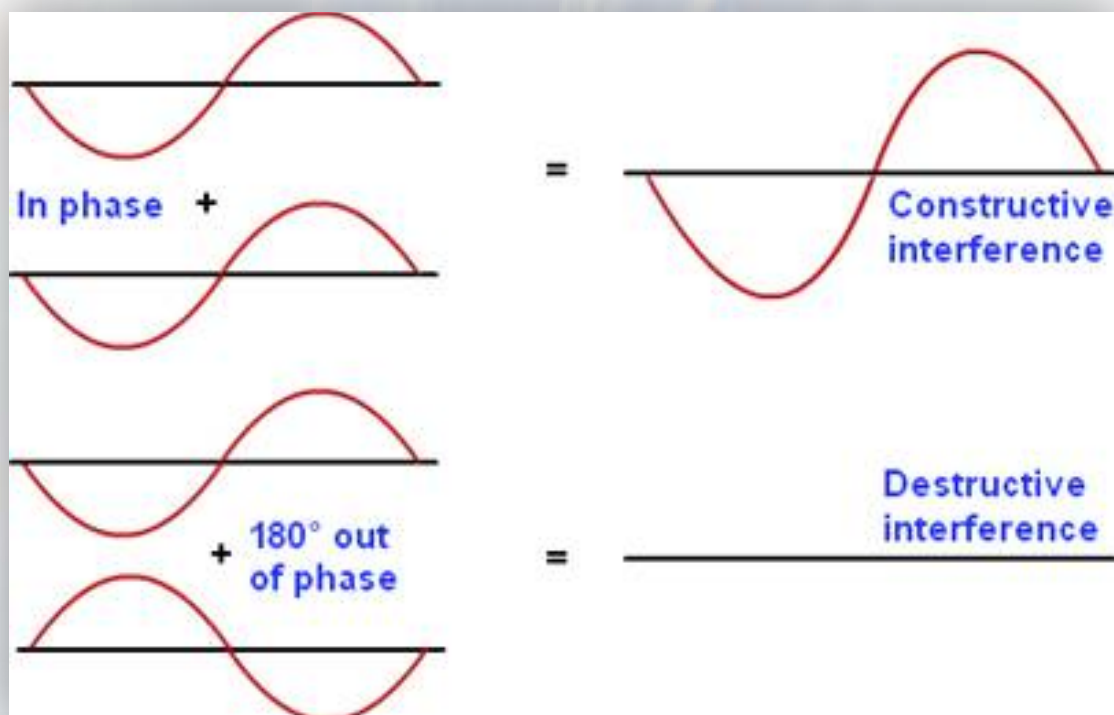
Waves will change their directions when propagating from one medium to another. This phenomenon is called refraction. In the ripple tank, if you put a transparent plate, the water above it is shallower, which is called shallow water region; while water in another region is deeper, which is called deep water region. These two regions are two different media. If the incident ray contacts the interface of two regions, it will refract. The speed of wave is related to the property of the medium. Therefore, for water waves with same frequency, the wavelength is longer in the deep water region while is shorter in shallow water region.

Wave's diffraction

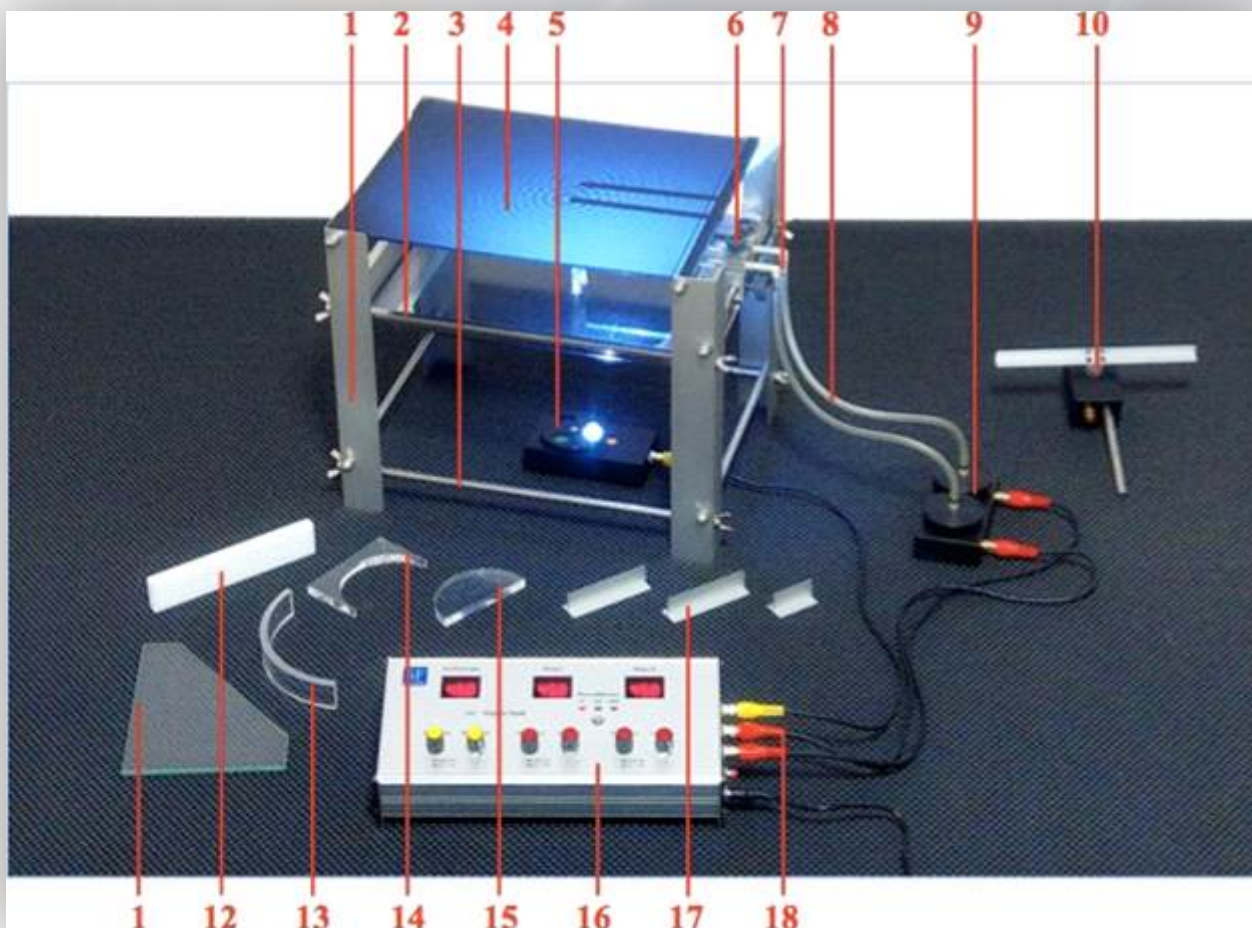
If straight waves or circular waves propagate in the water and bump into a barrier or a slit, they won't reach the rear area of the barrier or the slit when the barrier is very huge or the width of the slit is larger than the wavelength. So they will move on straightforward and produce a region resembling shadow area. When the barrier or the width of the slit is too small, we can find that waves won't propagate in the same direction when they pass by, however, they will be point waves and reach the backside of the barrier, which is called diffraction.

Wave's interference

When two waves propagating in the same medium superimpose, particles in the area of superposition will be under the effect of two waves. If amplitudes of waves are not very big, the vibrating displacement of particles in area of superposition is equal to the displacement vector sum produced by each wave. This is called superposition principle. If the crests (or troughs) of two waves reach the same spot at the same time, we call two waves are in phase at that spot. At this time, the interference wave will produce the maximum amplitude, which is called constructive interference. However, if the crest of one wave and the trough of the other reach the same spot at the same time, we call two waves are out of phase at that spot. At this time, the interference wave will produce the minimum amplitude, which is called destructive interference.



Equipment



- 1,2,3 Ripple tank x1
- 4.viewing screen x1
- 5.LED color light projector x1
- 6.Point wave generator x2
- 7.Fixer of point wave generator x2
- 8.Plastic tube for point source x2
- 9.Air pump for point wave generator x1
- 10.Plane wave exciter 18cm length x1
- 11.Trapezoid glass plate for water depth propagation velocity.
- 12.Plastic reflect plate x1
- 13.Plastic convex concave mirror x1
- 14,15. Plastic convex concave lens set x1
- 16.Digital Electronic strobe/ripple generator x1
- 17.Obstacle sets for diffraction and interference.
- 18.RCA signal connector x1

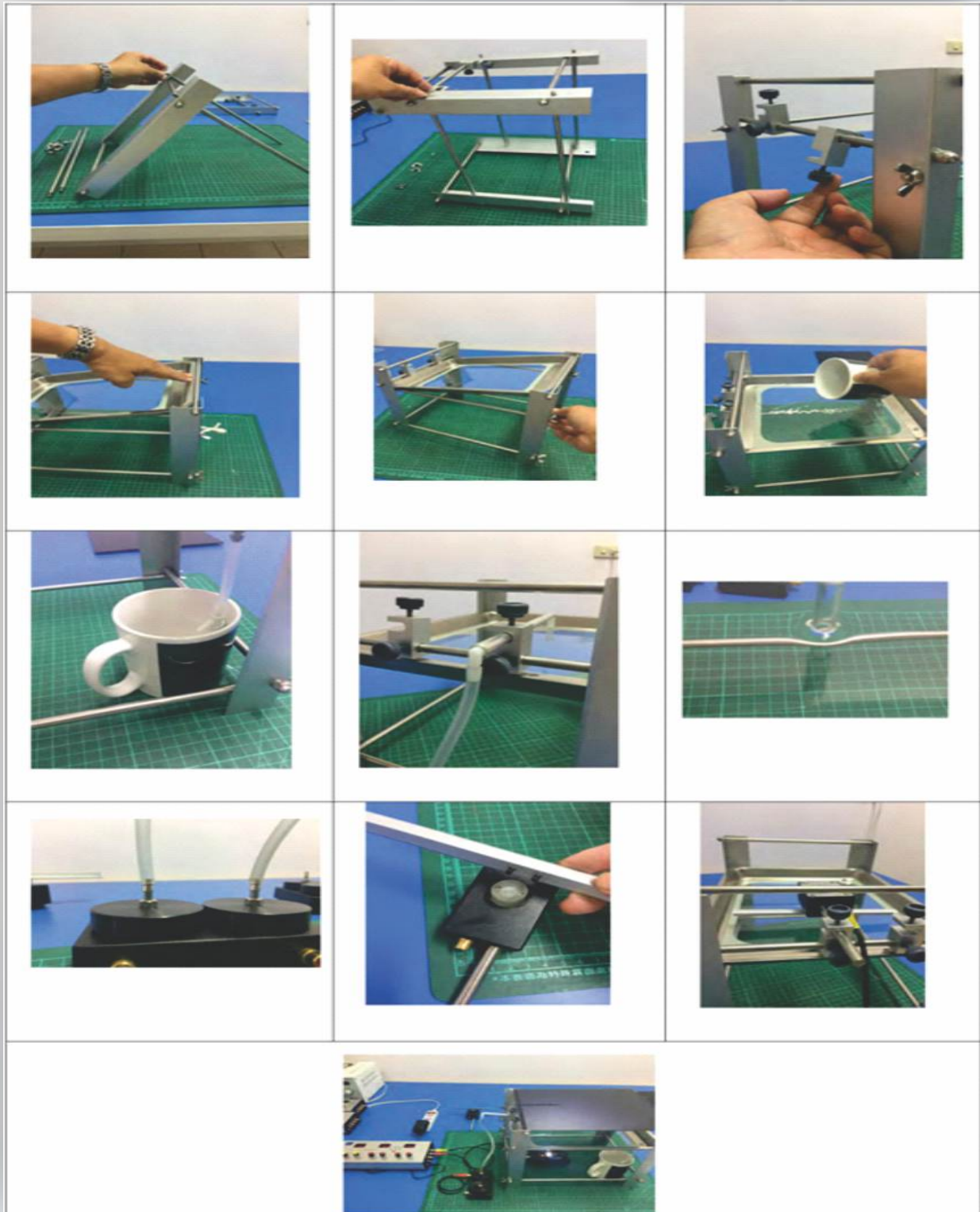
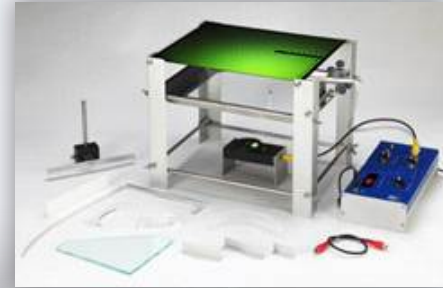
Instruction for frequency generator



1. Input: Use electric transducer DC9~12V to connect the power source and make the signal generator operate.
2. Stroboscope frequency controlling button: It can control the glittering frequency of LED stroboscope in the signal generator. Preset frequency is 45Hz, which fit for iphone take picture. If you press it, you can produce the mode of moving waves which are not synchronous. With brightness control knob.
3. Wave I frequency controlling knob of wave generator: It can control the vibrating frequency of wave generator I. The preset frequency is 45Hz, Turn left to decrease while turn right to increase. With Vibrate intensity control knob.
4. Wave II frequency function and control same as Wave I.
5. The three set frequency generator accurate to 0.1Hz for you can experiment" beat "
6. Phase difference designed three 0°/90°/180° can use at any synchronous frequency
7. Wave I output: Connect to the straight wave generator by AV signal connector to produce straight waves or Connect the air pump and air gun with the hose to produce point source.
8. Wave II output: Same as Wave I.
9. LED light source output: Connect light source generator with AV signal connector and produce projecting light source at any position of tank bottom. It can turn to select project color light.
10. Frequency display screen of wave generator: Show the current frequency of the wave generator.
Suggestion the lively face upside.

Installation, Procedure and Result

Assemble the equipment. See figure .



Point wave

Procedure

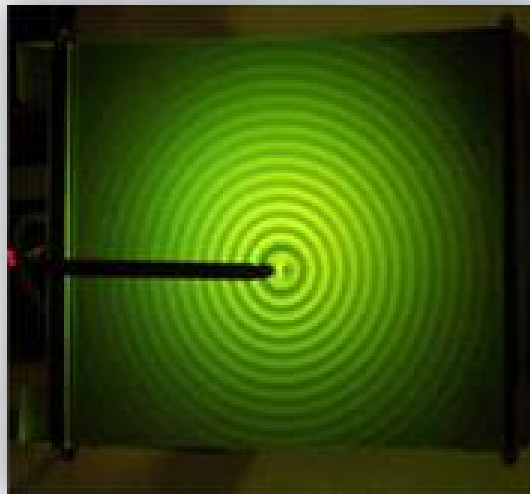
Pour pure water into the tank with depth 1.5~2cm. Moisten the walls around the tank and accessories for this experiment. Please connect the drainage device to the hole of the tank and close it to make sure the water won't flow out.

Adjust the supporters to make the tank horizontal.

Connect the back of the air gun with frequency generator. Make the front of the air gun close on the liquid surface.

Turn on the power source of the digital frequency generator and adjust the frequency of LED stroboscope and wave generator until the frequency is suitable for observation. If two frequencies are the same (synchronous), the image of the water wave on the display screen is still. On the other hand, if two frequencies are different (not synchronous), the image of the water wave on the display screen is moving.

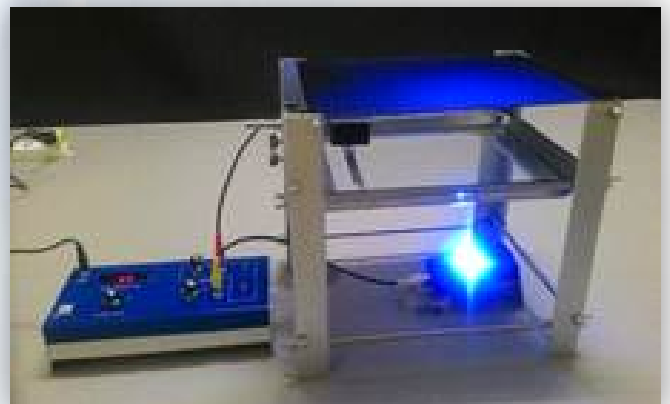
Result



Straight wave

Installation

Assemble the equipment. See figure



Procedure

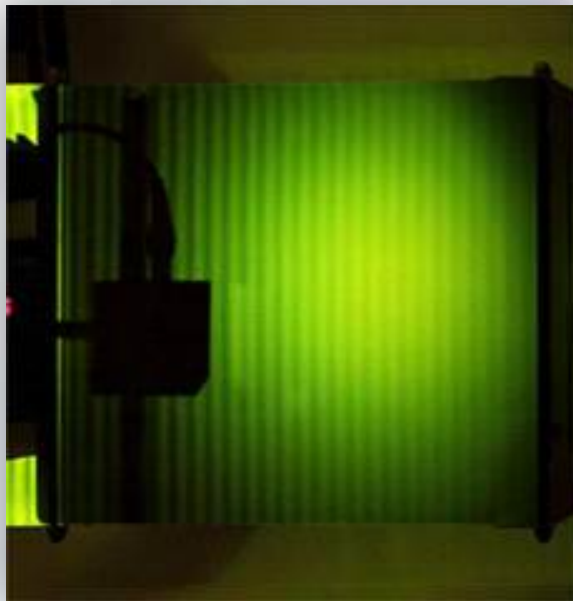
Pour pure water into the tank with depth 1.5~2cm. Moisten the walls around the tank and accessories for this experiment. Please connect the drainage device to the hole of the tank and close it to make sure the water won't flow out.

Adjust the supporters to make the tank horizontal.

Connect the frequency generator with AV signal connector and make the front of the straight wave generator close to the fluid surface.

Turn on the power source of the digital frequency generator and adjust the frequency of LED stroboscope and wave generator until the frequency is suitable for observation. If two frequencies are the same (synchronous), the image of the water wave on the display screen is still. On the other hand, if two frequencies are different (not synchronous), the image of the water wave on the display screen is moving.

Result



Wave's reflection

Procedure

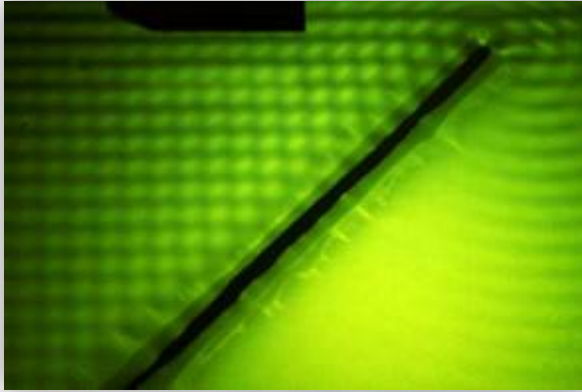
Pour pure water into the tank with depth 1.5~2cm. Moisten the walls around the tank and accessories for this experiment. Please connect the drainage device to the hole of the tank and close it to make sure the water won't flow out.

Adjust the supporters to make the tank horizontal.

Connect the back of the air gun with frequency generator. Make the front of the air gun close on the liquid surface.

Turn on the power source of the digital frequency generator and adjust the frequency of LED stroboscope and wave generator until the frequency is suitable for observation. If two frequencies are the same (synchronous), the image of the water wave on the display screen is still. On the other hand, if two frequencies are different (not synchronous), the image of the water wave on the display screen is moving.

Result



Concave and convex mirror

Put plastic concave and convex mirror in the tank.

Procedure

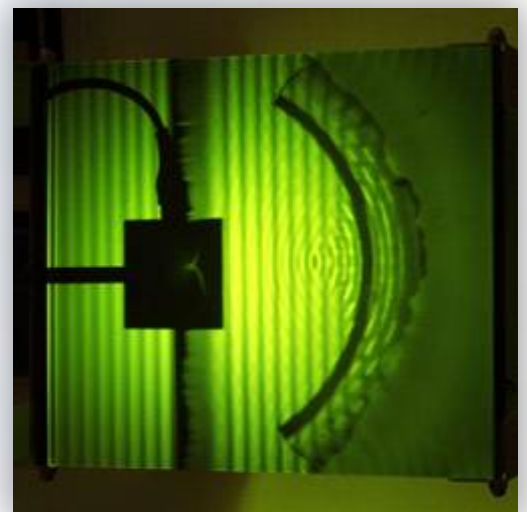
Pour pure water into the tank with depth 1.5~2cm. Moisten the walls around the tank and accessories for this experiment. Please connect the drainage device to the hole of the tank and close it to make sure the water won't flow out.

Adjust the supporters to make the tank horizontal.

Connect the frequency generator with AV signal connector and make the front of the straight wave generator close to the fluid surface.

Turn on the power source of the digital frequency generator and adjust the frequency of LED stroboscope and wave generator until the frequency is suitable for observation. If two frequencies are the same (synchronous), the image of the water wave on the display screen is still. On the other hand, if two frequencies are different (not synchronous), the image of the water wave on the display screen is moving.

Result



Wave's refraction

Trapezoid refractive glass plate

Put the trapezoid refractive glass plate in the tank.

Procedure

Pour pure water into the tank with depth 1.5~2cm. Moisten the walls around the tank and accessories for this experiment. Please connect the drainage device to the hole of the tank and close it to make sure the water won't flow out.

Adjust the supporters to make the tank horizontal.

Connect the frequency generator with AV signal connector and make the front of the straight wave generator close to the fluid surface.

Turn on the power source of the digital frequency generator and adjust the frequency of LED stroboscope and wave generator until the frequency is suitable for observation. If two frequencies are the same (synchronous), the image of the water wave on the display screen is still. On the other hand, if two frequencies are different (not synchronous), the image of the water wave on the display screen is moving.

Result



Concave and convex mirror

Put concave and convex mirror in the tank.

Procedure

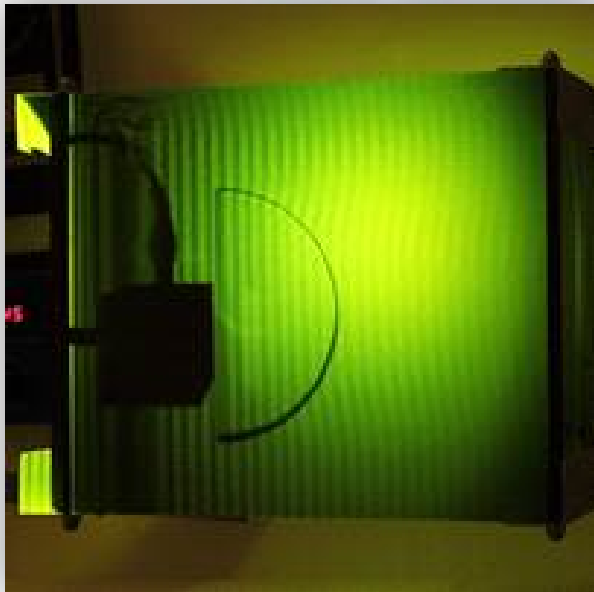
Pour pure water into the tank with depth 1.5~2cm. Moisten the walls around the tank and accessories for this experiment. Please connect the drainage device to the hole of the tank and close it to make sure the water won't flow out.

Adjust the supporters to make the tank horizontal.

Connect the frequency generator with AV signal connector and make the front of the straight wave generator close to the fluid surface.

Turn on the power source of the digital frequency generator and adjust the frequency of LED stroboscope and wave generator until the frequency is suitable for observation. If two frequencies are the same (synchronous), the image of the water wave on the display screen is still. On the other hand, if two frequencies are different (not synchronous), the image of the water wave on the display screen is moving.

Result



Wave's diffraction

Put diffracting ripple stopper in the tank.

Procedure

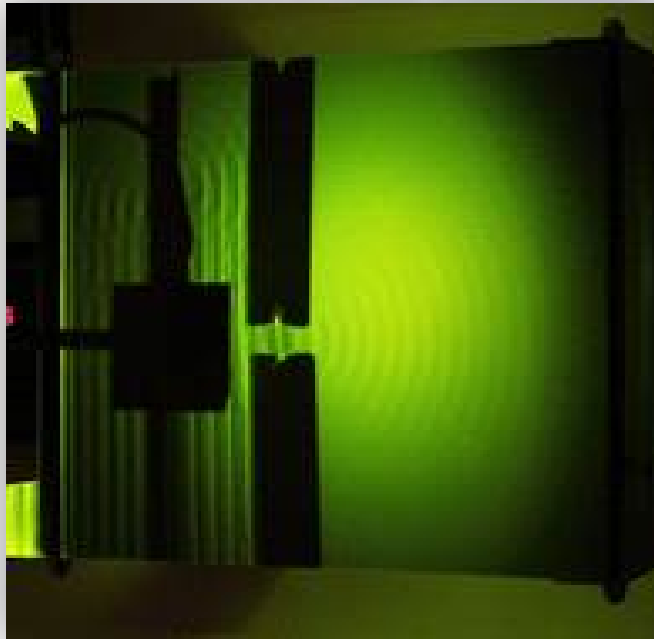
Pour pure water into the tank with depth 1.5~2cm. Moisten the walls around the tank and accessories for this experiment. Please connect the drainage device to the hole of the tank and close it to make sure the water won't flow out.

Adjust the supporters to make the tank horizontal.

Connect the frequency generator with AV signal connector and make the front of the straight wave generator close to the fluid surface.

Turn on the power source of the digital frequency generator and adjust the frequency of LED stroboscope and wave generator until the frequency is suitable for observation. If two frequencies are the same (synchronous), the image of the water wave on the display screen is still. On the other hand, if two frequencies are different (not synchronous), the image of the water wave on the display screen is moving.

Result



Wave's interference

Put interference ripple stopper in the tank.

Procedure

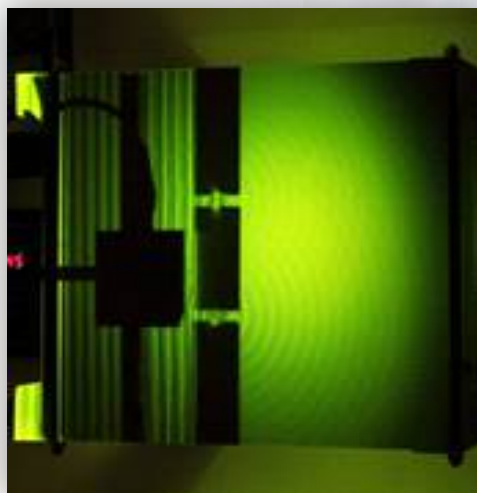
Pour pure water into the tank with depth 1.5~2cm. Moisten the walls around the tank and accessories for this experiment. Please connect the drainage device to the hole of the tank and close it to make sure the water won't flow out.

Adjust the supporters to make the tank horizontal.

Connect the frequency generator with AV signal connector and make the front of the straight wave generator close to the fluid surface.

Turn on the power source of the digital frequency generator and adjust the frequency of LED stroboscope and wave generator until the frequency is suitable for observation. If two frequencies are the same (synchronous), the image of the water wave on the display screen is still. On the other hand, if two frequencies are different (not synchronous), the image of the water wave on the display screen is moving.

Result



Dual point wave

Installation

Assemble the equipment. See figure



Procedure

Pour pure water into the tank with depth 1.5~2cm. Moisten the walls around the tank and accessories for this experiment. Please connect the drainage device to the hole of the tank and close it to make sure the water won't flow out.

Adjust the supporters to make the tank horizontal.

Connect the back of the air gun with frequency generator. Make the front of the air gun close on the liquid surface.

Turn on the power source of the digital frequency generator and adjust the frequency of LED stroboscope and wave generator until the frequency is suitable for observation. If two frequencies are the same (synchronous), the image of the water wave on the display screen is still. On the other hand, if two frequencies are different (not synchronous), the image of the water wave on the display screen is moving.

Result





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