Matelco "Théorie de la cinétique des gaz" P104.26

Kinetic Gas Theory set no. 2185.50

25.06.92 Ae 218550

The Kinetic Gas Theory set no. 2185.50 is used to model the behavior of gas molecules in a closed container. The molecules of the gas are represented by 51 steel ball bearings. In the kinetic theory of gasses the random kinetic energy of the molecules increases, as a gas is heated, thus increasing the pressure of the gas on the sides of the container.

In this demonstration, kinetic energy is imparted to the ball bearings by a vibrating plunger which fits into a slot in the bottom of the container.

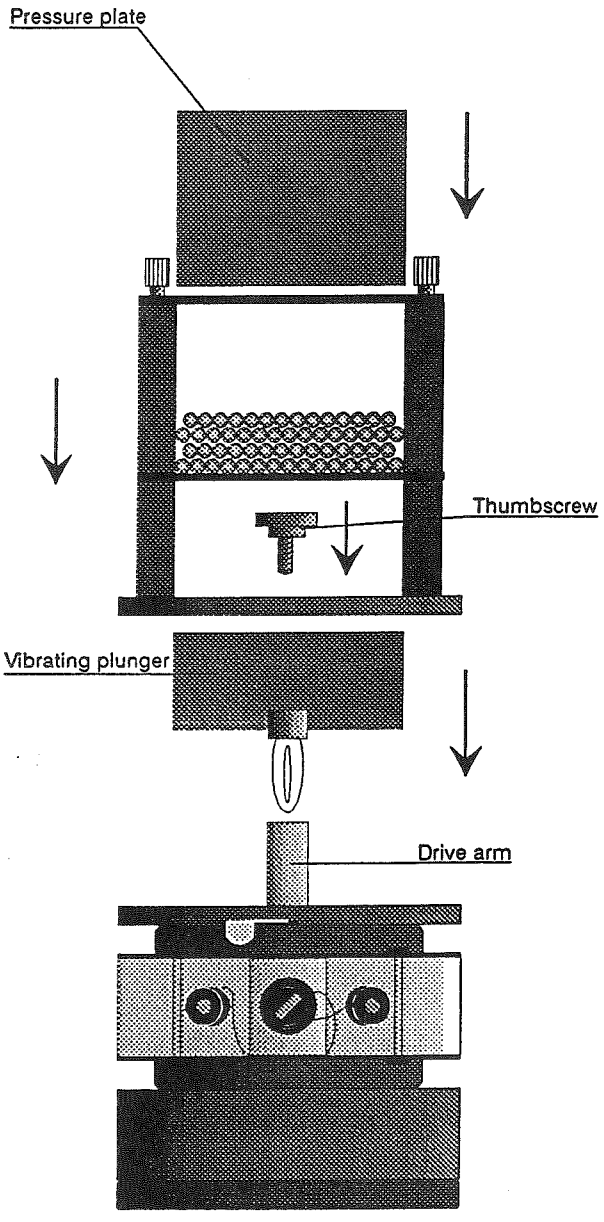
The Kinetic Gas Theory set has been designed as an accessory for the Vibration Generator no. 2185.00 (which is not included in this set)

The Kinetic Gas Theory set includes the following equipment:

1 pcs.	Cylinder w. 51 steel ball bearings
2 pcs.	Thumbscrews for attaching the cylinder to the vibration generator
1 pcs.	Pressure plate
1 pcs.	Plunger w. banana plug connector
1 pcs.	Disk f. brownian movements
1 pcs.	L-shaped steel base f. OHP
1 pcs.	Manual

1.
Set up the Kinetic Gas Theory set as shown in fig.1, but leave the pressure plate out for now.
The banana plug connector on the plunger fits into the drive arm of the Vibration Generator. The base of the ball bearing container then mounts to the top of the Vibration Generator using the 2 thumbscrews to hold it in place. The plunger slides through the slot in the bottom of the glass-walled container.

2.
Connect a Function Generator (e.g. no. 2500.00 or 2501.00) or a stepless regulated AC voltage 0 - 5 V/50 Hz to the Vibration Generator. Start with minimum amplitude and low frequency (a few hertz) vibrations. Vary the amplitude and/or frequency of the vibrations and observe the effects on the ball bearings. As the energy transfer to the ball bearings increases, the motion of the bearings increases. Students can thus get a sense for how a solid substance, when heated,



Vibration Generator no. 2185.00

fig.1

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goes through phase tranformations. I.e. first to a liquid state and then to a gaseous state. They can also note how the bearing density varies with altitude, much as the densisty of the atmosphere varies with altitude.

3.

Now slide the pressure plate into the slot in the top of the container - see fig. 2. Vary the amplitude and/or the frequency of the vibrations. Students can observe how the pressure exerted by the bearings increases with increasing kinetic energy. They can also see how increasing the kinetic energy of the bearings (i.e. heating up a gas) can cause work to be performed on the pressure plate, as heating a gas can cause a piston to rise in a heat engine.

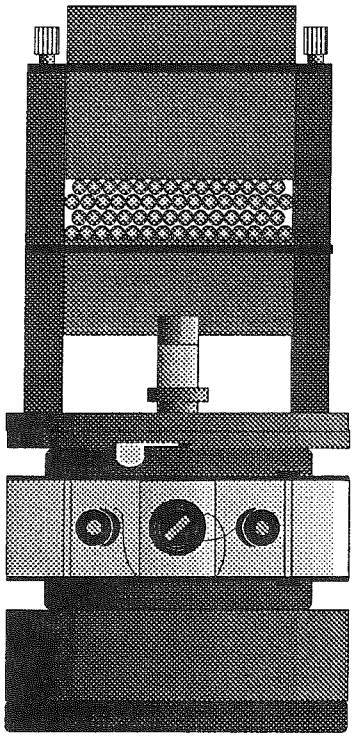

Fig. 2

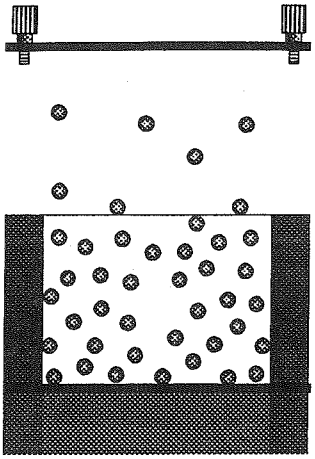

Fig. 3.

4.

The top lid with the guiding notch for the pressure plate may be removed, simply by unscrewing the 2 thumb screws. N.B. don't tilt the cylinder, as nothing stops the steel balls from rolling out.

By varying the energy applied from 0 up to an appropriate level, it will now be possible to demonstrate the phase transformation of a substance e.g. water, from the solid state (ice), to the liquid state (water) and to the gaseous state (steam). In this case the steam is represented by the steel balls which are thrown out of the cylinder - Fig. 3.

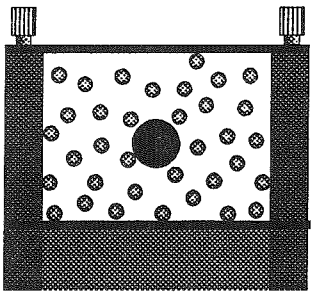

Fig. 4.

5.

The brownian movements can be demonstrated by placing a small disk (included) in the cylinder - Fig. 4.

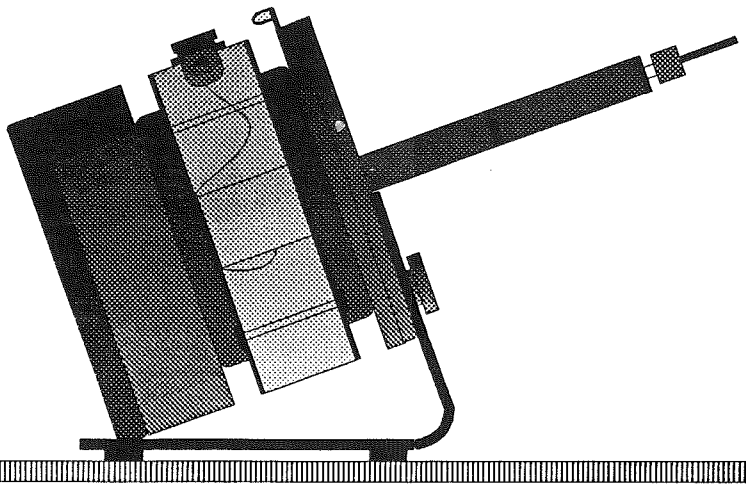

Fig. 5

Overhead-projector

6.

For demonstration purposes it may be of help to use an Overhead-projector. For this purpose the Kinetic Gas Theory set is supplied with an L-shaped steel base which is attached to the app. (2185.00 + 2185.50), simply by removing one of the thumb screws, place the hole in the steel base over the screw hole and re-mount the thumbscrew again. When the steel base has been mounted as shown in fig. 5, simply place the app. on the Overhead-projector and carry out the experiments as described above.