

up-country, most places where camphor is now manufactured can be considered as more or less quiet.

The British consul at Tamsui, quoted in The Board of Trade Journal, states that since it has been decided by the Formosan government to institute a camphor monopoly, production has materially increased, owing to the high prices ruling in Hong Kong during the last few months.

The monopoly was to come into force July 1, 1899, and from that date the government alone was to be allowed to purchase camphor from the producers. As they will only buy a certain quantity per annum, they will have absolute control of the working of camphor, together with all matters respecting the cutting down of trees, etc.

Permits will be issued to producers, and anyone having the proper concession papers, and who has taken out a license in due form, will be allowed to produce camphor.

The government will itself undertake the sale of the raw camphor, after production, in its unrefined state, and will dispose of it to purchasers at certain points to be determined upon by the government. These places will probably be Daitotei (Twatutia), Shinchiku (Tekcham), Tokoham, and the towns on the west coast where camphor has usually hitherto been deposited awaiting transport.

The government has already fixed the price of camphor for the period from July 1, 1899, to the end of the financial year at 30 yen (say £3) per 100 catties (say 133½ lb.). The consul is of opinion that this price would seem to be too low, and that it will very probably be raised for the following reasons:

If the government buys at 30 yen at the places of production, i. e., as it comes out of the stills, this would give the manufacturer only 2 or 3 yen profit, not taking account of possible and probable losses occasioned by typhoons or other causes; while if the government proposes to make its purchases at Daitotei (Twatutia), Shinchiku (Tekcham), and the other places mentioned, 30 yen would be quite insufficient to give a profit after deducting expenses for cost of transport from the stills and loss in weight. This last item alone would amount to at least 10 per cent.

The present monthly export to Hong Kong may be calculated at from 2,000 to 2,500 boxes from Tamsui, and say from 100 to 200 boxes from Kelung to Japan. Owing to the enhanced prices ruling in Hong Kong, in anticipation of the monopoly, the total export from the island has increased by about 600 boxes a month.—Journal of the Society of Arts.

#### AN ACOUSTICAL METHOD FOR THE DETERMINATION OF THE MELTING POINT OF FATS AND WAXES.

By EDWIN DOWZARD, F.C.S.

NUMEROUS methods have been proposed for the determination of the melting point of fats and waxes. In some the melting point is the temperature at which the fat undergoes a certain degree of softening, either sufficient to allow a plug of the sample contained in a cylindrical tube to be forced up by the pressure of water, or to allow the sample to form a globule.

When a capillary tube is used, there is some uncertainty as to whether the melting point is that tempera-

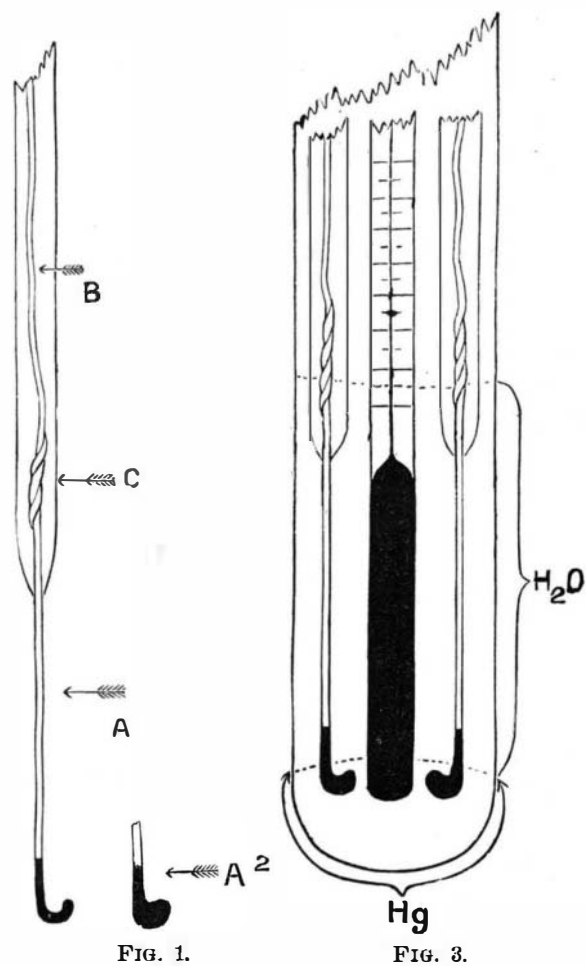


FIG. 1.

FIG. 3.

ture at which the fat commences to liquefy, or that at which it becomes clear and transparent.

On the Continent Pohl's method is frequently used. The bulb of a thermometer is immersed in the melted sample, and quickly removed, so that a thin coating only of fat adheres to it. After several hours the thermometer is inserted into a test tube so that the bulb is at a distance of half an inch from the bottom; heat is then gradually applied, and the temperature noted at which a drop of liquid fat is observed to form at the bottom of the bulb.

In nearly all the methods that have been proposed there is the method of personal equation.

The method about to be described, which eliminates

the error due to personal observation, is based on the following: Two platinum wires, connected to a battery and electric bell, are coated with the fat or wax, and immersed in mercury, which is gradually heated; when the fat melts, the circuit is closed, which is indicated by the ringing of the bell.

Fig. 1, which represents the actual size of the original, consists of a piece of stout platinum wire, A, with a crook at the extremity, fastened to a long piece of copper wire, B; the platinum wire is fused into the glass tube, C, which is about 10 inches long. In the apparatus about to be described there are two of these wires identical in size and shape. The modus operandi is as follows: The sample of fat or wax is melted in a small

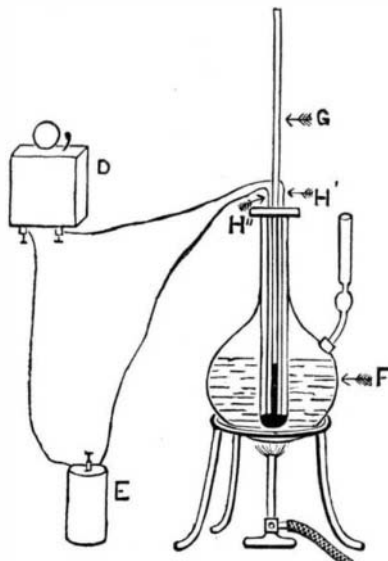


FIG. 2.

capsule, the platinum wires are dipped into the melted sample, taken out, allowed to cool, and the process repeated about three times; the wires will then have the appearance of A<sup>1</sup>, Fig. 1. The coated wires are allowed to stand for three or four hours, and then placed in the inner tube of an Anschütz and Schulze melting point apparatus, Fig. 2, F, along with a thermometer. A quantity of mercury is now introduced into the inner tube, sufficient to allow the wires to be immersed to the top of the crook; water is then poured in until the bulb of the thermometer is completely covered. The outer flask is filled with water to the same level as the water in the inner tube. The wires are now connected with the battery and bell, and the temperature gradually raised; when within about 4 degrees of the probable melting point, the temperature should rise at the rate of about 1 degree in 70 seconds. The reading is taken immediately the bell rings.

Fig. 2 represents the complete apparatus. H H' are the wires, and G the thermometer.

Fig. 3 represents the bottom portion of the inner tube (full size).

Of course I do not claim this method to be original, as several chemists have proposed and described various modifications in the way of apparatus.

The above is simply the description of a modified form of apparatus which I have found to give useful and constant results.

#### THE REPLACEMENT OF FLUIDS INTO THE TRACK OF MOVING BODIES.

THIS is a converse case to the preceding discussion. Only in this instance, gravity alone is responsible for the action of replacement. The secondary lines of force radiating from the common center of displacement, however numerous they may be, must of necessity leave interstices, as they radiate in space. The particles of fluid filling these interstices move outward in unison with the adjacent particles, lying in the force lines, until their separation becomes great enough to overcome cohesion, then the intervening matter being free to move starts inward toward the axis of forward motion, and is uniformly accelerated by gravity. Now, considering the different relative positions occupied by these respective particles of fluid, in regard to that of a uniformly advancing point, situated in the same straight line as the points from which they start to move are located; a parabolic branch is again described, but in reversed position to that of the one of displacement. And, as this replacing action occurs simultaneously from all points in the periphery of the displacing section, the enveloping surface of a paraboloid is again developed.

This paraboloidal space, if not filled with the solid matter of the moving body, will be occupied by the fluid itself. This body of fluid is pressed against the receding disk by the resultant forces developed in the direction of its line of motion. And this pressure, due to gravity, being constant in its action (at the same level), the movement of this body of fluid is uniformly accelerated; so, no matter how fast the disk may move, the fluid will always be against it, for there is no "head resistance," the pressure being expended on the disk itself, and is the same case as if a body were moving in a perfect vacuum. If it were possible for the disk to instantly obtain its full velocity, a vacuum would result, and continue to exist, if enough speed were maintained. Then, an increase of the impelling force, according as the vacuum is more or less perfect, becomes necessary in order to maintain this velocity.

As the replacing force, gravity is altogether independent from the impelling force of the disk; it matters not whether the space developed be filled or empty, so long as the velocity remains unaltered the orbits of the returning particles remain unchanged. The air filling this space need not be "dead air," but is most commonly in rapid circulation.

Now as the developed paraboloid moves in unison with the advancing disk, the space traversed between first and second moment of consideration would again be void if it were not for the fluid moving inward from the surrounding space. These particles of fluid acquire the same uniformly accelerated velocity, traversing

equal distances in equal periods of time, as bodies falling from a state of rest, hence their velocity depends in any particular case on the distance traversed; the distance from a point in the periphery of the advancing disk to its center of displacement. Hence this distance and the rate at which the disk moves determines the shape of the paraboloid generated, i. e., whether it be blunt or sharp. The relative length being directly proportional to the velocity.

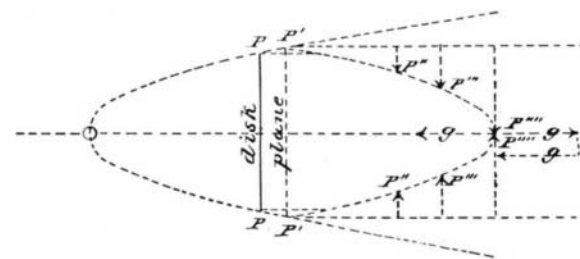
This is a reason why a rapidly moving vessel must have a longer "run" than one moving at slower rate of speed. As already deduced, the particles striking each other at the axis of motion give out rectangular resultants. If we consider two opposite particles of the fluid moving inward in the same right line, and confined to a plane of action that passes through the axis of forward motion, then will the resultant forces created by their contact be confined to the same plane of action, and there will be but two resultants, one acting forward, the other backward. As the two inward forces were each equal to gravity (g), their sum will be 2g, and the resultants representing an equal division of this sum will each be equal to (g) the other. The force (g) that acts toward the disk helps to hold the conoid of fluid against the disk as before mentioned. The other force (g) acting backward is resisted by an equal force (g) acting forward, which represents the forward thrust of the replaced fluid. These two equal forces acting against each other, as far as this problem is concerned, may be said to cancel each other.

Now, if the fluid be air or gaseous, this later action is reflexive, producing compression, condensation, rarification, and sound. This accounts for the whistling sound associated with the flight of rapidly moving objects. If the fluid be water, then the reaction of these forces is shown in the formation of a ridge of water or wave, caused by lifting a portion of the water above its surface, and which has the appearance of following the moving object, as it is continuously generated or produced. The water is forced upward because of the lesser resistance of the atmosphere, the forces acting toward the point of least resistance. This also is the cause of vessels raising a bow wave, or wave of displacement at their stems, the upward resultants of the resistance and impelling force lifting it in this instance. When the course of the moving body is directly downward, the resultants acting backward in its course are for a time greater than the downward resistance of the fluid, and an upward current is created; this gives rise to the apparent ebullition of the water, such as is noticed when a stone is dropped into it. If the object fall swiftly enough, then a fountain-like jet is also thrown upward in its course at the instant of its disappearance beneath the surface.

The actions and reactions in both the displacement and replacement of fluids is precisely the same if the fluid is stationary and the object moves, or if the object is stationary and the fluid moves against it. Hence, try the experiment of holding a partially immersed disk at the surface of a rapidly flowing stream of water or oil; if the former be used, then grease the disk to insure smoother lines of action, or let oil flow on the water's surface. Also the disk must be held perfectly perpendicular to surface and course of the fluid. The flow must be rapid enough to develop an opening behind the disk. The disk used, if shaped on the immersed end in form of a circle, ellipse, or parabola, will develop a smoother surface of displacement.

Now, it will be observed that the replacing action, or inward movement of the water, does not occur immediately at the plane of the disk, but at some distance back of it in the edge or periphery of some imaginary plane parallel to the real disk. This fact is partly due to "inertia," or to the resistance of the particles of fluid to being turned from their established orbits, and, also, to adhesion, as before mentioned.

Should the velocity be great enough, this distance becomes very perceptible, amounting to several inches or feet, as the case may be. If the exact diameter of the plane developed at point of greatest width and its distance from the disk could be determined accurately by measurement, we could determine the orbit developed by the use of these measurements without regard to the forces acting.



If the movement be too slow, the space developed back of disk fills with water as fast as formed, but if rapid enough, then it is filled with air and water, the relative volumes of which are inversely as their densities, i. e., more air than water. It is hardly possible to apply enough power to the disk to develop a velocity that could produce a vacuum. There is no doubt but that the atmospheric pressure is greatly reduced in the immediate track of a projectile or shot, still not enough to produce a theoretically perfect vacuum. This track is at first filled with the gases of combustion, which follow along with it till condensation ensues.

Friction, as commonly considered, is made up of two factors, adhesion and pressure per unit of area. All pressures due to forces have already been considered in this problem, so we will have to deal with friction as with adhesion itself. As this is in direct ratio to the area of surface, the cross-section that develops the least surface will develop the least friction. The surface of the developed paraboloid is as the periphery of displacing disk when same speed is maintained. So also the section having the greatest area with shortest bounding line develops a paraboloid with greatest volume to area of surface evolved.

A 10-foot square, having an area of 100 square feet, has a perimeter of 40 feet. A 11'3-foot circle of same area (100 square feet) has a periphery of 35'5 feet, hence will generate less surface than the square. A rectangle of same area must of necessity have a longer