

## SCIENCE NEWS

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## DROPPING LIQUIDS

PROFESSOR E. A. HAUSER, and Drs. H. E. Edgerton and W. B. Tucker, of the Massachusetts Institute of Technology, in making 800 silhouetted photographs of a drop of water growing at the end of a tiny tube and finally breaking off to fall with a soft *plash*, are probing deeply into the mechanics of dripping water. They are showing exactly how the drop of water forms, and why a drop of water tends to become a sphere. Water drops tend toward a sort of "best size." When water was dripped from brass tubes whose diameter was less than half a centimeter (about a fifth of an inch), the hanging drop was larger than the diameter of the tube. When the tube was made larger, the size of the drop decreased.

Small drops are clean drops, that is, they come off cleanly, one at a time. But large drops have a "neck" between the drop and the end of the tube. And the larger the tube and drop, the more pieces the neck breaks into in falling.

It has long been known that dissolving various substances in water changes its surface tension. It has also been known in a relatively vague way what changes took place when particular amounts of a substance were added. But Professor Hauser and his associates, by examining with their camera the shapes and sizes of drops of these liquids have found out definite things about surface tension.

A viscous or thick liquid, such as the grease that goes into an automobile's springs, doesn't behave at all like a liquid. Such liquids have a marked ability to form threads. Their photographs showed that when glycerine, a liquid used among other things as an anti-freeze, drops from the end of a tube, a tough neck was formed and that many drops "remained joined by practically invisible threads."

Cautiously they say that the ability of viscous liquids to form threads may throw new light on the actual nature of viscosity—an important matter in a world that uses immense quantities of lubricants. From earlier knowledge of how lubricants work has come better and cheaper lubricants; from further study of the new results will come something even better.

Their studies, reported recently before a meeting of colloidal chemists, are not the only ones dependent on high-speed cameras. For in special cameras the scientist has a remarkably powerful tool: he can, just as these three did, take pictures in a hurry to examine at leisure.—LEONARD H. ENGEL.

## LIQUEFACTION OF GASES

GASES like hydrogen, nitrogen, oxygen and air can be liquefied more quickly by making them whistle, according to a patent granted to Dr. Chester W. Rice, of the General Electric Company, Schenectady, N. Y.

The rate at which a gas can be liquefied depends on how fast heat energy can be removed from it. The faster the extraction of energy, the faster the gas is cooled and becomes liquid. Dr. Rice has discovered that he can

remove energy from the gas to be liquefied by making it whistle; in other words, he transforms some of the energy of the gas into sound energy. As the gas merrily whistles away it becomes cooler and cooler until it turns to liquid.

When this "whistle" feature of cooling gases is hooked up with the conventional method of liquefying gases, the net result is liquid gas at a faster rate than heretofore possible.

Dr. Rice's apparatus works this way: The gas to be liquefied—air, for example—is compressed to a pressure of 3,000 pounds per square inch. The heat thus "squeezed" out of the air is absorbed by ice, while the compressed, preliminarily cooled air passes down through a series of coiled pipes into the liquefying chamber. Here it is allowed to expand through a small opening, or throttle valve, down to atmospheric pressure or to about 15 pounds per square inch. In so expanding the gas' temperature is lowered. The air expanding from the valve blows through a whistle in the liquefying chamber, thus further extracting heat energy from the air by converting it into sound energy. A marked cooling effect results.

Now the cooled air is fed back over the coil pipes containing the compressed air, thus cooling it. The cooler compressed air upon expanding through the throttle valve, and whistling through the whistle, drops to a still lower temperature than did the first portion. Thus, the effect becomes cumulative and the temperature of the expanding and whistling air becomes lower and lower until it is so cold that it liquefies.

Now if the noise or sound made by the whistling gas were permitted to remain in the liquefying chamber it would be re-converted into heat which would reheat the gas. Hence, to avoid the loss of the cooling effect produced by whistling the gas, Dr. Rice has built his apparatus with special ducts. These conduct the sound produced by the whistle out of the liquefying chamber into a distant chamber filled with sound absorbing material which converts the sound into heat energy. This heat is removed by cold water flowing through cooling coils arranged within the sound absorbing material.

The gas cooling whistle is adjustable so that it can be set at a pitch that will convert the greatest amount of heat energy of the gas into sound energy. This ingenious apparatus gives a continuous supply of liquid gas at a faster rate than previously possible.

## A THEORY OF THE CAUSE OF CANCER

CANCER occurs because cells of the body which were never meant to be parents of new cells suddenly begin to have large numbers of offspring. The reason they do this is because of a change in their hereditary make-up. This is the explanation which Dr. J. P. Lockhart-Mummery, of London, presented as his theory of the cause of cancer at the recent meeting of the American College of Surgeons in Chicago.

The theory, as Dr. Lockhart-Mummery pointed out,

does not seem to help to solve the problem of how to prevent or cure cancer. But in the past when the cause of a disease was discovered it generally led to the discovery of some means of prevention or cure. The same may prove to be true in the case of cancer. At all events, the key to the problem of what causes cancer has been found, he believes, in the science of genetics.

Two kinds of cells in the body are recognized, germ cells, which have nothing to do with disease germs, but are the cells that are involved in reproduction and carry hereditary characteristics from one generation to the next and somatic cells which do not have numerous progeny. When a somatic cell dies it is replaced by another single cell.

Sometimes, apparently, the hereditary factors, or genes, get mixed. Genes are better known as carriers of traits such as the color of eyes or the shape of noses. They also carry all the other features which make a particular individual—either a person or the innumerable tiny cells which make up his body—one sort of person or cell instead of another. When cancer develops, according to Dr. Lockhart-Mummery's theory, it is because there was a biologic change in the genes of somatic cells which endowed them with the power of having offspring. This change is called a mutation and is not reversible.

Experimental proof for this theory can not be given at present, Dr. Lockhart-Mummery said, because genes "are and always must remain invisible to the human eye and gene mutation can not ever be visible." His theory rests instead on the way it explains logically the known facts about cancer and fits in with other findings, such as those of Dr. Maud Slye on the genetic factors in mouse cancers.

### A POISONOUS ELIXIR OF SULFANILAMID

Food and Drug Administration agents are seizing stocks of the so-called elixir of sulfanilamid, wherever they can find them, while five new deaths from the same preparation were reported from East St. Louis, in addition to the nine in Tulsa, Okla., where the trouble first broke out.

Due to weaknesses in the existing Food and Drug Law, action can not be taken on the grounds of the alleged harmfulness of the compound, but a loophole was provided by the manufacturer, who labeled his product an "elixir." Since the drug was dissolved in diethylene glycol, which is not technically entitled to figure as a solvent when the product is labeled an elixir, the preparation could be legally condemned as a misbranded article. On this accidental technicality the Food and Drug Administration has been able to proceed. Warnings have been sent to Canada also, since some of the drug may have been exported.

Government chemists and biologists are making an intensive study of the properties of sulfanilamid, to discover whether it is really the harmful agent. The cases are still very puzzling because this chemical has been used successfully in the treatment of tens of thousands of infection cases, with no deaths until those of the luckless 14 self-medicating patients during the past few days. Food and Drug Administration officers deplore the possibility, under existing legislation, for pharmaceutical companies and retail druggists to sell over the

counter to laymen powerful drugs that are apt to be very dangerous unless used under a physician's directions.

### CAMOUFLAGED INSECTICIDES

CAMOUFLAGED insecticides are the latest development in the battle against crop-destroying insects, according to a patent granted to Mayne R. Coe, of the U. S. Department of Agriculture.

Blending with the color of the plants on which they are sprayed, such insecticides—just as camouflaging conceals tanks, guns and battleships in war time from an enemy—are invisible to attacking hordes of insects.

Inventor Coe's patent is for an insecticide, such as nicotine dust, pyrethrum powder and rotenone, the individual particles of which are covered with a thin film of pigment or dye. Chlorophyll green, the pigment which gives leaves their color, is the camouflaging "paint."

Primarily, Mr. Coe's invention is concerned with preserving the killing power of insect poisons. Nicotine, pyrethrum and rotenone are effective bug killers immediately after spraying, but lose most of their death-dealing power after a few hours of exposure to sunlight. Only certain rays are responsible, however. Mr. Coe's patent covers means for shielding out the rays that are harmful to the insecticide.

Enclosing each particle of the spray does the trick, the patent papers state. The protective screen is "painted on" by mixing the insecticide in a water solution of gelatine or glucose and the chlorophyll dye. The mixture is then sprayed on the plants, the gelatin acting as a glue to make the camouflaged insecticide particles stick to the plant.

### THE DEATH RATE OF PATENTS

INABILITY to make their patents pay would cause the death of half of America's 720,000 patents now in force if patent owners were compelled to pay a tax to keep them alive.

This is the verdict of what is probably the first study of the "death rate" of patents ever made. The study, carried out by U. S. Patent Examiner P. J. Federico, is reported in the current issue of the *Journal of the Patent Office Society*.

Approximately \$2,000,000 in taxes could be collected if patents were taxed to keep them in force throughout the 17-year period for which they were granted. The additional revenue would enable the patent office to reduce its fees for a new patent from sixty to twenty dollars.

But the taxes, on the basis of what has happened in Great Britain and Germany, would cause the death of half of the patents issued before their seventeen years of life expired. A variety of reasons would lay behind the action of the owners of 360,000 patents in allowing them to die. But they can all be summed up in one phrase: trials of a few years would convince their owners that those 360,000 patents won't pay.

While the article is careful to point out that this picture is derived from calculations based on assumptions, yet it is as close to a "scientific guess" as probably can

be made. For back of it is a careful statistical analysis of the death rate of patents in England and Germany.

These countries, like other large countries in the world except the United States and Canada, require owners of patents to pay taxes at regular intervals to keep the patent from lapsing.

In England while a patent is granted for a term of 16 years, beginning with the fifth year the owner must pay a tax of five pounds (about \$25), else the patent dies and he loses all rights under it. The taxes increase every year thereafter, so that to keep the patent alive throughout the full 16 years requires about \$630 in taxes. In Germany, fees total more than \$2,000.

Studying the survival of patents in these two countries as affected by taxes, Mr. Federico found that the death rates coincided. This is amazing when it is considered that these patents were granted under different systems, that in Germany taxes begin earlier, are heavier and increase at a more rapid rate than in England.

In fact when charted, the death rates follow the same curve which can be expressed by an exact mathematical equation.

Of 255,992 patents granted in England over a 21-year period (1884–1904), 172,750 (68.5 per cent.) were permitted to die by owners failing to pay the first tax due on the fifth year of their term. Only 11,081, or 4.3 per cent., paid taxes and “lived” for the whole term they were granted. However, during more recent times (the period 1920–1935) a greater proportion paid annual taxes. Some 54 per cent. paid the first tax and 4.6 per cent. the last. In Germany the proportion follows the same pattern.

Proposals for taxing patents in this country have come up several times before Congress in the past. Latest suggestion has come from the President’s Advisory Board, which recommended a system of annual taxes.

The main objectives back of the proposal are:

1. Such taxes would get out of the way “dead wood” patents—those of no value, which do not produce any revenue for their owners, yet may keep other inventors from stepping in and developing the field.
2. Such taxes would permit reducing the inventor’s burden by reduction of the \$60 fee now paid to Uncle Sam on filing the application and getting the patent.

### ITEMS

KUDZU, more familiarly known through the South as “porch vine,” has been put to work to literally “rope down” the soil against erosion. Soil conservation experts, of the Department of Agriculture, report that “porch vine” forms an ideal soil binder, for it rapidly produces a dense growth whose runners bind the topsoil in place, thus stopping the inroads of the weather on the countryside. Runners 60 to 70 feet long, with new roots every few feet at the nodes, characterize the vine, which is also a legume, thus serving to fertilize the soil at the same time.

THE supervoltage x-rays used in treating deep-seated cancers can be accurately standardized for the first time, the U. S. Bureau of Standards has announced. Measurements up to 400,000 volts have been made for such stan-

dardization by two scientists of the bureau’s staff, Dr. Lauriston S. Taylor and George Singer. The significance of the work is that it takes the “chance” out of previous work in the field of high-voltage x-ray therapy. Previous experimenters have used 400,000 volt x-ray without knowing, truly, what dosage they were administering. They obtained different results with the higher voltage rays but were unable to know whether the effect was due to the characteristics of the more piercing radiation or to inequalities in x-ray dosage. The new Bureau of Standards work permits dosages of radiation up to 400,000 volts to be known accurately for the first time. Previously 275,000 volts was “tops” for such calibration work.

ULTRA-VIOLET rays are responsible for radio troubles as well as for sunburn. Contrariwise, they are responsible for our having radio at all, as they are for the more moderate effects on the skin. The sun’s effects on the earth’s outer atmosphere have been the subject of intensive research by workers of the Carnegie Institution of Washington. Dr. A. G. McNish, of the Department of Terrestrial Magnetism, reports that solar radiation, especially in the ultra-violet region, produces three layers of electrically charged particles far out in the fringes of the atmosphere, in what is known as the ionosphere. The lowermost of these layers is about 60 miles up, the uppermost is three times that far away. Each of these layers serves as a reflector to radio waves, bending them back toward the earth. Without them there could be no long-distance radio transmission; the waves would simply fly off into outer space. But when the radio roof is bombarded by unusually heavy bursts of ultra-violet, everything goes wrong and radio is blanketed out. These bursts, usually of very short duration, occur when explosive disturbances take place on the sun, usually during times when sun-spots are unusually numerous.

A DISPATCH from I. Papanin, leader of the Soviet North Pole Expedition states, “Depending on the authority of Nansen, many experts in their articles point to the absence of life in the Arctic Ocean. Our drift from the Pole to the 85th parallel lay, it would seem, along waste places absolutely devoid of life. We have, however, witnessed most interesting phenomena. When, on the day after we landed at the Pole, we heard the chirruping of a bird, we did not believe our own ears. Then we saw the bird. We immediately assumed that the bird had been brought on one of the airplanes. However, later, other birds of different species appeared here also. Shirshov (the hydrobiologist) always gets a rich catch at various depths—consisting of medusa and all kinds of crustacea. In the open water not covered by ice we have often observed the consumers of this small life—sea hares and seals. We wanted to photograph a sea hare with our cinema camera but it proved to be too cautious. Once I succeeded in shooting a seal but unfortunately the current drew it down under the ice. We have no doubt that we shall have fresh meat in our kitchen. Finally, the terror of all animals—the white bear. Peary, returning from the Pole, saw bear tracks at the 86th parallel. At the 88th parallel, we were visited by three bears.”