

## • New Machines and Gadgets •

☛ **GLEAMING BICYCLE** pedals that reflect back light from the headlights of an approaching automobile whether the auto approaches from the front, rear or the side, is the safety measure provided by a recent patent. The reflectors are easily attached to the pedals and do not interfere with their operation.

Science News Letter, October 24, 1942

☛ **MORE MILES** per tire is the object of a new cotton protector that goes in between the inner tube and the tire casing, protecting the inner tube from rough and broken cords on the inside of the casing. Thus both can be used longer.

Science News Letter, October 24, 1942

☛ **IMPROVED ANTIGLARE** and safety goggles, composed of metal instead of glass or other transparent material, are now available. Each eye-covering has two slits, one horizontal, the other vertical, permitting vision in these two directions. In the new goggles, there is an additional slit lower down and slightly inclined to permit downward vision. The metal is strong enough to protect against flying fragments, and steam or perspiration do not interfere with vision. A crude form of this arrangement is said to have been invented by the Eskimos to prevent snow blindness.

Science News Letter, October 24, 1942

☛ **A PEN OR PENCIL CLIP** made entirely of plastic is the subject of a recent patent. Several kinds of plastic are now available, the inventor states, that are sufficiently springy to replace the metal clip entirely. Others will require reinforcement with a small strip of metal, which will also aid in fastening the clip to the pen cap.

Science News Letter, October 24, 1942

☛ **A BOTTLE CAP** that can be removed with the bare fingers, thus saving the annoyance of a lost opener, has recently been patented. The cap is made in two halves which lock together. A little tab which can be lifted by the fingers separates them and opens the bottle. This, however, is one of the conveniences for which we will have to wait until after the war.

Science News Letter, October 24, 1942

☛ **DEATH TO DISEASE** germs is administered by the luminous tubes seen



in the photograph. They stand guard at the entrance portal for the ventilating air of a war factory. Unseen ultraviolet rays which they emit, deal death to airborne bacteria.

Science News Letter, October 24, 1942

☛ **A CHILLING TANK** for bronze bushings illustrates one of the many ways in which refrigeration is helping to speed up war production. The castings are dipped in a 50-50 mixture of antifreeze and water kept at 30 degrees below zero. This enables them to be machined soon after leaving the mold, avoids the long cooling process and several months of seasoning formerly required.

Science News Letter, October 24, 1942

If you want more information on the new things described here, send a three-cent stamp to Science News Letter, 1719 N. St., N. W., Washington, D. C., and ask for Gadget Bulletin 127.

### MATHEMATICS

## Amount of Oil in Sands Depends on the Grains

➤ **HOW MUCH** oil can an oil sand take up? This problem is of importance not only to the petroleum geologist but to the physicist, chemist and botanist.

The answer is given by Dr. Edward Kasner, professor of mathematics at Columbia University, in a report to the American Mathematical Society. If the grains are perfect spheres, all equal, he says, then for the closest packing

25.955% of the whole space will be vacant, and can be filled with oil or other liquid; while 74.055% will be occupied by the sand.

This mathematical result can be tested experimentally by filling a box with sand and then seeing how much water can be poured in.

The proportions of occupied and unoccupied space will be the same whether the spheres are large or small, provided they are all equal. But if they are unequal, (and suitably arranged) then a larger portion of the space can be occupied by the sand, and consequently less oil or water taken up.


This may easily be visualized if we pack a box with oranges. Between the oranges we might insert nuts, between these and the oranges we might get in some peas, and in the spaces still vacant fine shot, and so on until we get down to the finest powders. Thus we would fill up more and more of the space.

Mathematically this could go on forever—an infinite series of spheres of diminishing size. Practically we have to stop with the smallest particle that can be handled. Experiments with mixed sands have in fact succeeded in reducing the vacant space to a few percent.

It is obvious that spheres, however packed, will have small gaps and therefore space can never be filled 100%. But by a suitable arrangement we can fill 99% or 99.999% or as near 100% as desired. The work is purely mathematical since we are dealing with ideal perfect spheres. In a similar way the plane can be covered with circles (coins or discs of various sizes).

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