

like those of natural or synthetic rubber.

In the manufacture of this new plastic, which may become a successful rubber substitute in tires, the polymer is mixed with a plasticizing agent in the usual

way, but with a curing agent added which makes vulcanizing possible. It then has twice the tensile strength of the uncured product.

Science News Letter, February 12, 1944

PHYSICS

Pitch Radioed at Night

Pure A above middle C may now be checked in evening with the 2,500 kilocycles per second frequency broadcast service of the National Bureau of Standards.

► MUSICIANS and manufacturers who want to check pitch can now tune in during the night with their shortwave sets to 2,500 kilocycles and get a musical sound guaranteed by the National Bureau of Standards to be pure 440 cycles per second, which is A above middle C in the musical scale. This radio frequency, 2,500 kilocycles per second, at night, is an addition, effective since Feb. 1, to the standard frequency broadcast service of the Bureau.

Since the same date, the pulse on the 59th second of every minute has been omitted. This government service, continuous day and night, broadcasts standard frequencies and standard time intervals from the Bureau's radio station near Washington, WWV. It makes the national standard of frequency widely available. This is of value in scientific and other measurements requiring an accurate frequency.

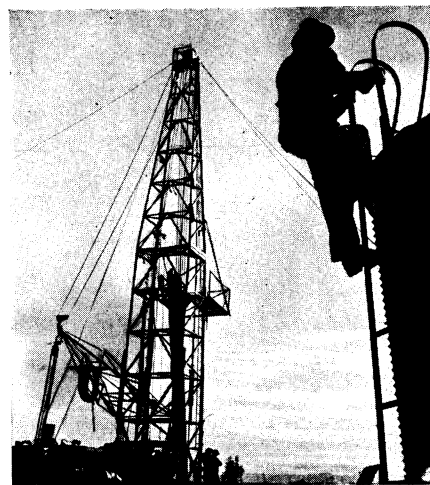
The Bureau's standard frequency broadcast service includes standard radio frequencies, standard time intervals ac-

curately synchronized with basic time signals, standard audio frequencies and standard musical pitch.

At least three radio carrier frequencies will now be on the air at all times to insure reliable coverage of the United States and other parts of the world. Two frequencies, 5,000 and 10,000 kilocycles per second, are on continuously day and night. A 15,000 kilocycles-per-second frequency is on the air from 7:00 a.m. to 7:00 p.m., with the additional frequency to be used, 2,500 kilocycles per second, from 7:00 p.m. to 9:00 a.m.

Two standard audio frequencies, 440 cycles per second and 4,000 cycles per second, are broadcast on the radio frequencies of 5,000, 10,000 and 15,000 kilocycles. The audio frequency 440 cycles only is broadcast on the 2,500 kilocycles. The 440 cycles per second is the standard musical pitch; the 4,000 cycles per second is a useful standard audio frequency for laboratory measurements.

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ARCTIC OIL—To help supply oil and gasoline for the U. S. and Canadian armed forces in the Alaskan zone, oil wells such as the one shown above, are being tapped at Fort Norman, 125 miles south of the Arctic Circle on the Mackenzie River. The joint U. S. and Canadian government development is known as the Canol project, Canol standing for Canadian Oil.

siopeiae, Dr. Struve states. (*Astrophysical Journal*, January)

A powerful stream of cool but rapidly moving gas flows out from the G star toward its companion. One part of the stream, presumably composed of the more distant or more rapid strata, expands outward and leaves the system. The other part flows around the A star, and having become hotter, but traveling more slowly, ultimately returns to the G-type star, Dr. Struve believes. It is not possible to see this streaming action, but spectroscopic studies make this the most plausible picture.

The stream of ionized metals such as calcium and iron flows at a height above the surface of the A star about equal to the star's diameter.

"The most interesting feature of SX Cassiopeiae is the observation of an approaching shell at and near secondary eclipse," the Yerkes director states. "These motions are plausibly attributed to the turning over of the stream due to conservation of angular motion. Only a part of the stream is retained by the system and completes the entire circuit around the A star."

The spectrum of this eclipsing double star is a blend of a true star of the G type, to which class the sun belongs, and lines of another origin which re-

ASTRONOMY

Star "Playing Catch"

Appears to be tossing part of its own atmosphere far out into space, clear around its companion, and recovering some of the flaming gases on its return trip.

► A STAR that appears to be "playing catch" with itself, tossing a part of its own flaming atmosphere far out into space, clear around its companion in a double-star team and recovering part of it on its return trip, is described by Dr. Otto Struve of the Yerkes Observatory.

The star is a rather faint double one, designated by astronomers as SX Cassiopeiae. Cassiopeia is the constellation landmarked by the great W-shaped group of stars on the opposite side of

the Pole Star from the Great Dipper.

As Dr. Struve pictures the phenomenon, a stream of gas issues from one member of the double-star team and divides on the far side of the second member. Part of the stream flows off into space, while part circles around the second star and returns to rejoin the atmosphere of its parent star. Some tenuous, absorbing cloud of gases acting in this manner would explain the peculiar variations observed in the case of SX Cas-

semble the shell lines of an A star, a type which has much hydrogen in its make-up.

The giant G-type star, which ejects the stream of gas, is believed to be larger than the luminous A-type star. The relative masses of the two, however, have not as yet been determined. The A star is completely eclipsed once every 36.567 days, giving a chance to study the G star directly. But the streams of gas from the G star are projected upon the disk of the bright A star, so that a clear view of it is never realized for study.

That SX Cassiopeiae was not just a simple system of two eclipsing stars was discovered by Mme. L. Ceraski at Moscow in 1907. Peculiar variations in the star's velocity curve were observed by A. H. Joy at Mount Wilson Observatory. These, Dr. Struve believes, are probably due to changes in the density of the gas within the streams.

"The entire picture is very similar to that observed in Beta Lyrae," he states, "only here the smaller, and probably less massive star, is the bright A-type component."

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PHYSICS

"Topography" of Crystals

Surface irregularities which are only a few molecules in depth are revealed by new photographic technique, in which two surfaces are silvered.

► THE UPS and downs, that is the topography, of an apparently flat crystal surface are revealed with startling clearness and highly increased accuracy by a new photographic technique making use of the interference of light. Differences in level as small as 1/5,000,000 inch, a step only a few molecules in height, can be detected.

The new technique is the work of S. Tolansky of the physics department of the University of Manchester, England, and is described in the British scientific journal, *Nature*. (Dec. 18, 1943)

An optical flat of high precision is brought very close to the crystal surface to be investigated. Such a flat is a piece of glass one surface of which has been ground and polished until it is as nearly as possible a perfectly plane surface. Both the surface of the crystal and that of the flat have been coated previously with a thin semi-transparent layer of silver, electrically deposited in a vacuum. The surfaces are then illuminated with the green light from a mercury arc lamp. This light is monochromatic—consists of only one wavelength.

The surfaces, as seen by the light reflected from them, do not appear of a uniform green tint. Instead, a pattern of light and dark bands appears. These are known as interference fringes, and are due to the alternate interference and reinforcement of light. In some places the light reflected from the surface of the crystal, the farther surface, combines

with the light reflected from the optical flat, the nearer surface, in such a way that the crests of one wave stream fall into the troughs of the other wave stream. This is interference. They annihilate each other and a dark band results.

Nearby, on either side, where the distance between the two surfaces is greater or less by one-half wavelength of the light used, the two reflected rays combine crest to crest, and a bright band results. The iridescent colors of very thin films, such as those shown by an oil spot on the pavement, are similarly due to the interference of light reflected from the upper and lower surfaces of the film.

Assuming the glass surface to be perfectly flat, the interference fringes thus show the ups and downs of the crystal surface. They are the contour lines of a topographical map of the surface, the distance from one bright fringe to the next corresponding to a change in level of one wavelength of the light used. For the green mercury light, this is about 1/50,000 inch.

This interference method has long been used for the testing of flat surfaces. What is new in the present technique is the silvering of the two surfaces—apparently a very small change, but it makes a whale of a difference.

Without the silvering, the fringes are broad and hazy, and it is impossible to measure from the estimated center of one fringe to that of the next with any great accuracy. With the silvering,



HUMAN GUINEA PIGS—In laboratory rooms simulating all kinds of weather—arctic blizzards, tropical rains, searing desert heats—various kinds of clothing for soldiers are tested by the U.S. Army Quartermaster Corps. Under the piece of clothing being tested, the volunteer wears an electronic contact harness, like the one on the man to the right, which constantly checks the temperatures of eight vital parts of his body.

the bright fringes are reduced to thin sharp lines with wide dark spaces between them, just like the thin sharp lines used on any topographical map. Measurement is easy and accurate.

By silvering the surfaces, their reflecting powers are increased to the extent that 85% of the light is reflected, only 15% transmitted. The consequence is that the light is reflected back and forth between the two surfaces many times before it emerges, and interference predominates over reinforcement.

Examined by the new method, the surface of mica is seen to consist of rounded humps and hollows. The contour lines are smooth and rounded like those of a sand dune country. The surface of selenite, on the other hand, is seen to consist of ragged ridges all running in the same general direction, resembling a plowed field.

A very important use of the new method is to disclose the cleavage lines on a crystal surface. These are abrupt steps, tiny nearly vertical cliffs, like the much larger cliffs that geologists call