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SCIENTIFIC EQUIPMENT OF THE STRATOSPHERE BALLOON

WITH a last minute check-up of instruments all but complete on July 13 and only favorable weather conditions needed for the departure of the stratosphere balloon *Explorer,* the intricate problems which face Captain Albert W. Stevens and Major William E. Kepner on their forthcoming ascension become clear.

Before the appearance of this note the two men will probably have taken off in a floating laboratory hopeful of conducting enough scientific tests to keep a university staff busy for months, and at the same time have a world's altitude record to think about. With a ton of instruments as their companions on the flight, Stevens and Kepner will be part of what might be called a scientific Christmas tree, for apparatus will cover the inside and outside of their gondola, hang by long ropes from beneath the balloon and be attached in every conceivable place.

Each day at the Stratocamp of the National Geographic Society-Army Air Corps expedition new apparatus has arrived for installation on the balloon with the hope of solving different scientific riddles. Now the situation has almost reached the state where the adventurers are beginning to wonder if they can operate all the apparatus.

Thirteen major objectives have already been outlined for the flight not including the sought-after altitude record. They are:

1. Collection of stratosphere air samples at many levels.
2. Taking of complete temperature and barometric data from the ground to the highest point attained.
3. Aerial photographs to check curvature of the earth, also the customary barometric system of measuring altitude.
4. Cosmic ray data with both electroscopes and Geiger-Muller counters.
5. Wind velocity measurements.
6. Check of solar radiation intensity.
7. Photographs of the sun's spectrum.
8. Determination of ratio between sky brightness and sun brightness; color of sky at high altitudes.
9. Tests on actinic effect of light.
10. Effects of altitude on radio transmission.
11. Effect of radiation, both solar and cosmic, on fruit flies as check on possible mutations.
12. Same for spores.
13. Technical problems of balloon navigation.

While much of the apparatus is automatic, it can be seen that Captain Stevens and Major Kepner will not be idle during their hours in the air.

TEMPERATURE OF THE STRATOSPHERE

EXPLORING the stratosphere by means of explosions set off on the earth's surface is one of the new methods of gaining information about this region without leaving the ground. The experiments are described by Dr. Kurt Wolcken, of the University of Göttingen, in *Forschungen und Fortschritte.*

It has often been observed, Dr. Wolcken writes, that a great explosion can only be heard within a radius of 80 to 100 miles. Beyond this limit there is a ring of silence, and then another zone, where the sound can again be heard. There is a skip zone for the sound just as there is for short radio waves.

Two theories have been proposed to explain the phenomenon. One is that the effect is due to the increase in wind velocity which occurs with the height. Sound is more often heard to the east in winter and to the west in summer, and other correlations with wind velocity and direction have been noted.

Another theory is that the effect is due to a rise in temperature in the upper stratosphere, but there is no experimental evidence in its support. Sounding balloons have seldom risen above 20 miles (the record is 22 miles). They have shown that the temperature diminishes to about minus 67 degrees Fahrenheit at a height of 8 miles, and then remains sensibly constant up to the greatest heights reached. Moreover, it is difficult to see why there should be a rise in temperature at greater heights, unless the upper layers of the stratosphere are for some reason more strongly heated by the sun's rays than the lower layers.

To test this temperature theory, experiments were made in the polar regions during the polar night 1932–33. Twenty-eight explosions were set off, using 13,500 pounds of explosives. The return sound was heard despite the fact that the sun's rays had not reached to air at a height of 65 miles for six weeks. The delay in the sound was about the same as in middle Europe, so that the sound must again have reached this height before returning earthward.

The conclusion drawn was that if there is a rise in temperature in the upper stratosphere, it can not be due to the sun's rays. It might be due to the cosmic rays or to the ozone layer.

DESTRUCTION OF TREES BY THE DUTCH ELM DISEASE

FINE old elm trees, of which the eastern states are so justly proud, are now succumbing to a renewed attack of the Dutch elm disease at the staggering rate of 200 a day.

The ravages of this affliction have become so serious that Congress appropriated $150,000 now being used for the work of checking the blight. Already the death knell has rung for 3,027 shade trees in the region around New York.

The greatest loss has been suffered by New Jersey, where the mortality of elms to date is 2,456. And each day new cases of the disease are discovered. The only check which has been found is to chop down and burn the trees the moment tests have shown them to be infected.

The Dutch elm disease first appeared in 1920 in Holland. It waged a destructive war against European elms and then proceeded to cross the ocean in the holds of

ships carrying elm logs for the furnitude industry. It made its first appearance in a flank attack in Ohio three years ago, but not seriously as only nine elms were felled and immediate action checked further damage.

In the last few months, however, it has stabbed the heart of the elm region around the port of New York. A small bark beetle, *Scolytus,* carries the infection in the form of a fungus known as *Graphium ulmi* which attacks the smaller twigs and withers whole branches of the tree.

None of our native elms seems to be immune, although an oriental variety is not infected. This tree, imported from Asia, can nevertheless be a harborer of the disease and should also be destroyed if it is found to be bearing the fungus.

When queried as to whether this epidemic will have the terrible effects of the blight which years ago stilled the whistles of so many chestnut vendors, the investigators of the U. S. Department of Agriculture state that it is equally serious from its present aspect. Whether a wholesale slaughter of elms will take place in the future can not yet be foretold.

CORN AND THE CHINCH-BUG

COUNT round one in favor of King Corn in his battle against Kid Chinch-Bug. With the able seconding of farmers and scientists, the most vicious onslaught of the boring-in enemy of the principal grain crop of the country has been stopped. The fight now enters the second round, with no predictions good for much, though the odds seem to favor corn again.

When the oats crop, the chinch-bug's first training-table, began to dry up in the early summer heat, the insects started their regular invasion of the cornfields. Here they were met by trenches, barriers of creosote oil, and pit-traps in which they could be burned or crushed. In general, throughout the whole corn belt of the Mid-west, alert farmers supplied with ammunition by state and federal authorities kept their fields free of the crawling hordes. Practically all the chinch-bugs that tried to get into the corn were blocked out, and subsequently destroyed.

Now the crawling stage of the first brood of the bugs has ended. The survivors that did not attempt direct assault on the corn have grown their wings and flown over the barriers. They are at present feeding in reduced numbers in the corn, but not doing it appreciable harm.

Their real threat will come after they have bred, for their offspring are the insects that will survive the winter, lurking in stubble and in the weeds and grasses of the fence rows, to be ready to make a fresh attack next year.

This renewed threat will be met by cleaning up the fields, plowing the stubble under, and where practicable by burning the growth along the fence rows.

Principally, however, the question whether 1935 will be another bad chinch-bug year will have to depend on the winter weather. January and February may be the Mid-western farmer's best friends, as they were once Russia's best generals, when Napoleon retreated from Moscow. But if the winter months turn out to be too mild, the chinch-bug war will have to be renewed next summer.

Chinch-bugs have spread over territory far to the north of their usual range, due to a succession of hot, dry summers in the past few years. In Iowa, for example, they normally occur in troublesome numbers only in the extreme southwestern corner of the state and to some extent across the southern tier of counties. At present they are rated as "bad" well up into central Iowa, as far north as Des Moines, and reported "present" clear up into the northeastern section, though not reaching to the extreme northeastern corner of the state.

EPILEPSY IN AN IDENTICAL TWIN

A PERSONALITY study of identical twins, only one of whom suffers from epilepsy, throws new light on the hereditary constitution of those subject to this disease. The case of these sisters, young girls strikingly similar in appearance, one of whom has been stunted mentally and in personality by the disease, has been reported to the American Neurological Association by Dr. Walter Freeman, of the George Washington University.

Physically, one of the girls might be the mirror image of the other, except that the epileptic patient is about an inch and a quarter shorter than her sister. They are similar in color of eyes and hair, skin texture, shape of ears and hands, tone of voice, and even in a peculiar characteristic fluttering of the eyelids and marked readiness to burst into tears with slight provocation. They have also followed very similar careers, both starting in the same occupation. Both are married—and to the same type of individual.

But the personalities and mental abilities show significant differences. Since they are identical twins with exactly the same hereditary make-up, scientists may be justified in assuming that the healthy sister presents a picture of what the other girl might have been had she not developed epilepsy. And their similarities in temperament throw light on what are the fundamental constitutional factors—the X-factor—present in the individual who is subject to epilepsy.

Both girls are intensely religious. As children they played at being hermits, and spent hours in church praying. Both are deeply affected by beauty in art and music. And both are decidedly self-centered and egotistical.

Mental tests show the healthy sister to be ten points ahead of her twin in intelligence quotient; she is alert and capable while the patient is rather dull. The healthy girl has also spent her spare time in study and has qualified for a superior position. The patient is meticulous about following instructions in detail, but is content to spend her spare time in light reading or desultory conversation.

The outstanding feature in the personality of both girls is self-centeredness. This and the supersensitiveness of both girls may be underlying characteristics of the epilepsy-prone person, according to Dr. Freeman. The strong religious tendency might also be characteristic of the epileptic personality, as many have previously held, or it might be a result of the early training of the girls. Other character traits of the epileptic, such as the dullness of mind, explosiveness of temper, performance by

rote of instructions, which have previously been thought a part of the epileptic personality, are really effects either of the original injury to the brain which caused the epilepsy or of the repeated "insults" to the brain from the epileptic attacks.

PLANTS THAT DEFY DROUGHT IN A DESERT

DROUGHT and heat mean nothing to a few species of extra tough plants that grow in a unique desert composed of drifting dunes of pure gypsum crystals.

Two hundred seventy square miles of these drifting gypsum crystals constitute the area known as the White Sands of southern New Mexico. These dunes are so white that it is almost impossible to avoid the impression that they are fifty-foot snow drifts. This illusion tends to weaken, however, when the thermometer registers 100 in the shade that isn't there. Studies of the adjustments to these peculiar conditions are now being carried on by Professor Fred W. Emerson, of New Mexico Normal University.

The gray or brownish dunes of impure quartz sand found in arid lands and along the shores of lakes or seas make hard conditions for the growth of plants, but these drifting piles of gypsum sand add new difficulties to plant life. Chemical tests show that there is not more than perhaps 2 per cent. of impurities in the gypsum, thus introducing difficulties in absorbing sufficient amounts of nitrates and other essential soil nutrients.

As in all drifting sand, there are only a few species of plants that are able to grow upward fast enough to keep from being covered by the advancing dunes. In the White Sands there are only six species that commonly succeed in the moving sand. They are a cottonwood, rabbit brush, aromatic sumac, a shrubbery pennyroyal, a yucca and that peculiar gymnosperm, *Ephedra*.

Some of the individuals of species that usually grow to be only shoulder high under ordinary conditions grow forty or fifty feet upward through the dunes. All of these develop numerous roots under the sand.

ITEMS

THAT the health of the country is not so good this year as it was last is shown by a study of the figures of life insurance companies and of the U. S. Census Bureau. 1933 was an all time record year for good health and officials of the Metropolitan Life Insurance Company consider 1934 "by no means an unsatisfactory year from the standpoint of public health." Yet up to the end of May the cumulative mortality rate was 4.4 per cent. higher than for the same months of 1933, and, according to the U. S. Census Bureau's records for 86 leading cities, the death rate up to the week ending June 2 was 5.1 per cent. above that for the corresponding part of last year. Deaths from measles and whooping cough were twice the number recorded last year. There have also been increases in the death rates for cancer, heart disease, diabetes, cerebral hemorrhage, chronic kidney disease, pneumonia, accidents and automobile accidents.

ENCKE'S COMET, most frequently returning of these visitors from space, has been picked up for the first time on its present visit to the sun's neighborhood. The discovery was made by Dr. Hamilton M. Jeffers, of Lick Observatory. One of the most reliable of all comets as well as shortest in period, Encke's comet has been observed to make its return every three and a third years for more than a century. It is now very faint and visible only through the largest telescopes. It is a diffuse spot of light without a tail. It was seen at just about the place in the heavens that computations made months ago indicated that it would appear. Details of the rediscovery of this comet have been relayed through Harvard College Observatory to astronomers throughout the world.

WHILE Dr. Sven Hedin, one of Sweden's best known scientific adventurers, is reported in the hands of Chinese bandits, other Swedish explorers are making ready for expeditions to distant fields. Crown Prince Adolf, who ranks as one of Sweden's leading archeologists, will set out for Bagdad in the autumn to take part in excavations in Mesopotamia. An ethnologist of the Swedish National Museum, Henry Wassen, is making ready to sail for South America, to continue studying the Chaco Indians of Colombia, a work begun by the late Erland Nordenskiold. The geologist Professor Hans Ahlmann will join with Professor Sverdrup to observe glaciers in the interior of Spitzbergen. And four Swedish zoologists are setting out for Brittany, to continue experiments with the eggs of sea-urchins, in research expected to throw valuable light on phases of evolution. Among Sweden's scientific representatives already abroad is Dr. Carl T. Hammarlund, who is studying potato plants in the mountains of Chile and Peru, in the hope of discovering a potato more resistant to frost and insects than potatoes now grown in Sweden. In India, Dr. Walter Kaudern is making biological studies and seeking rare orchids, with the mission of bringing back their seeds for the King of England.

ACTING as an overcoat not only for the tree but also for any insect pests that may be harbored beneath it, the thick bark of western pine trees protects both themselves and the pests, according to Dr. F. P. Keen, of the U. S. Department of Agriculture. Temperatures from 15 to 35 degrees below zero are not uncommon during the winter in regions where this pine grows, but the insects are not killed. On comparing the temperature beneath the bark with the air temperature, one half-inch of bark was observed to cause a difference of 8 degrees, a one-inch bark a difference of 18 to 21 degrees, and a two-inch bark a difference of 29 degrees. With the internal temperature that much higher than the air temperature the bark-beetle mortality from the cold, though increasing with the decrease in temperature, is especially severe below 17 degrees; but this internal temperature is not frequently reached in the case of deeply hibernating beetles. The insect mortality, Dr. Keen says, is 55 per cent. at 11 degrees, 64 per cent. at 14 degrees and 73 per cent. at 17 degrees below zero.