SCIENCE NEWS

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AN INFRA-RED PLANE DETECTOR

THE reported British sensitive detector for airplanes, which makes use of invisible rays from the plane's engine, probably employs the infra-red radiation given off from any hot object and makes it visible by a method similar to that employed in the electron microscope recently developed to permit ultra high magnification. A similar American device is said to have been tried at the recent maneuvers of the First Army, but no details have yet been made public.

At the December, 1935, meeting in St. Louis of the American Association for the Advancement of Science, Dr. Vladimir K. Zworykin, of the Radio Corporation of America, showed an infra-red telescope that caused excited comment. In a Science Service dispatch at the time, Watson Davis, director of the service, described it as follows:

"The new device, which looks like a telescope from the outside, does its seeing by the infra-red rays that the unaided eye cannot see.

"The heart of the new infra-red 'eye' is a thin film of caesiated oxidized silver, deposited on a metal plate. This substance is especially sensitive to infra-red light, from the limit of visibility, at about 8,000 Angstrom units, to about 10,000 units.

"When the infra-red image of some object, either giving off infra-red rays itself or reflecting them from an infra-red searchlight, is focused on this special film, it gives off a stream of electrons from all the lighted parts of the image. These shoot up a tube, passing through a series of electrically charged rings. This bends them as a lens bends light. This part of the apparatus it called an 'electron lens.'

"The focused stream of electrons, now arranged in image form again though invisible, strikes a second screen, this one covered with a fluorescent substance, working on the same principle as the ordinary fluoroscopes used in hospital x-ray rooms. This turns the invisible electron image into a visible light image, very clear and distinct. The process is thus summed up in three steps: first, the infra-red rays from the object itself; then, the translation into electrons; finally, the second translation of electrons into an image shown in visible light."

At that time, possible wartime uses were predicted. The infra-red rays are given off at night as well as during the day. They pass freely through haze and smoke, but any fog, except a very thin one, stops them. However, such a fog would hamper the movements of the airplane in any case. Funnels of warships, like airplane engines, also emit infra-red rays, as do clouds of hot gases from engine exhausts. The device can be used for invisible signaling with an infra-red searchlight as transmitter and an infra-red telescope as receiver. An observer not provided with such a telescope, even in the path, would be unaware of the rays going past him.

The electron microscope, demonstrated by Dr. Zworykin last April to members of the American Philosophical Society, employs the electron lens. Magnification of ordinary microscopes is limited because they will show no details smaller than the waves of light with which they are viewed. But the electrons are still smaller, and by focusing these, extreme magnifications up to 20,000 times or more, have been secured.

SYNTHETIC SAPPHIRES

THE war in Europe threatens to cause a shortage of synthetic sapphires used as the jewels in fine American watches. These tiny bits of very hard material are essential as the bearing surfaces of pivots and other parts of watches, chronometers, and such scientific apparatus as balances and meters.

The supply from Switzerland, Germany and France, where they are made, has been cut off by the war. There is no American industry established because of the low cost at which the European manufacturers were able to furnish satisfactory watch jewels, the price being about a cent and a half each.

Costume jewelry, largely made of synthetic gems and even cheaper glass imitations, is also being curtailed by the war.

It is known that at least one leading watch manufacturer has appealed to government agencies for help in meeting the shortage. An attempt may be made to establish an American industry to meet the need.

Since 1902 synthetic rubies and sapphires have been manufactured by the Verneuil process, which fuses alumina (Al_2O_3) in an oxyhydrogen blowpipe to produce a substance that chemically is the same as the naturally occurring rubies and sapphires.

Synthetic gems are chemically and physically identical with the natural stones, except for minor internal structure that does not affect their usefulness. Rubies or sapphires, either natural or manufactured, differ only in their coloring; red stones are called rubies and all others are sapphires. The red of rubies is caused by chromium oxide in small amount; the blue of sapphires is due to iron or titanium. Synthetic white sapphire is the same as natural colorless corundum.

In the process of manufacture extremely pure, finely powdered alumina must be used. The fusing process results in a pear or carrot-shaped mass of alumina of from 300 to 400 carats. This boule, as it is called, is split into halves and then sawed into watch jewels and instrument bearings. The hardness of rubies and sapphires is 9 on the usual scale of hardness, ranking next to diamonds with a 10 rating.

The most important centers for the manufacture of the various types of synthetic rubies, sapphires and other gems are Locarno and Monthey, Switzerland; Annecy and Jarrie, France; and Bitterfeld and Zwickau, Germany. These plants are stated to have a daily capacity of 750,000 to 1,000,000 carats. Three-quarters of the output finds industrial use.—WATSON DAVIS.

NEW PATENTS

PART of the support system of the new 200-inch telescope, being completed at the observatory of the California Institute of Technology on Mt. Palomar, is covered by a patent just granted to Reinout P. Kroon, of the Westinghouse Electric and Manufacturing Company at Lester, Pa. The patent, number 2,212,346 and one of 741 granted this week, is assigned to the Westinghouse Company.

Mr. Kroon was one of the engineers in charge of the work on the telescope mounting, which was built at the Lester plant. With the telescope so large and heavy a certain amount of distortion of the great yoke structure which holds the tube is unavoidable. However, this must not be transmitted to the tube itself, for it would spoil the alignment of the mirrors and other optical parts, thus ruining the star images. Mr. Kroon solved the problem by hanging the bearings, in which the tube moves, on a system of radial rods, somewhat like the wire spokes of a bicycle wheel. These keep the bearings centered at the right place, yet permit a certain amount of freedom in the supporting yoke.

In his patent specifications, Mr. Kroon states that, while his invention "has been described with particular reference to a telescope, it is to be understood that it may be used in any situation where similar conditions and requirements are encountered."

Dr. August H. Pfund, professor of physics at the Johns Hopkins University, was granted patent 2,212,211 for a method of detecting and measuring certain gases when mixed with other gases. He claims that the apparatus can detect 1/1000 of one per cent. of carbon dioxide in air. One possible use is in the detection of minute quantities of the poison gases used in war.

The method is applicable to gases consisting of more than one kind of atom. Thus, carbon dioxide consists of carbon and oxygen, hydrogen sulphide of hydrogen and sulphur, nitrous oxide of nitrogen and oxygen. It will not detect gases like oxygen, hydrogen or nitrogen, which consist of atoms of the same kind.

When infra-red waves, like light, but too long to affect the eye, pass through these gases of several kinds of atoms, certain wave-lengths are absorbed and converted into heat. Conversely, if the gas is heated, these same wave-lengths are emitted.

In one version of the apparatus, a jet of the gas to be detected is heated by an electric coil. It becomes a miniature broadcasting station, sending off waves of its proper length. These are reflected back and forth in a metal cylinder, then out the other end to a thermopile, which converts the infra-red waves to electricity and indicates their presence on an electric meter.

In use, the cylinder is first filled with air known to be free from the gas, and the current measured. Then the mixture being investigated is admitted instead. If this contains the suspected gas, a large part of the waves is absorbed, and the current is reduced. Even if other gases are present, they do not affect the results, because they are not tuned in to the proper wave length and cause no absorption. In another method of using the principle, Dr. Pfund measures the heating produced in the gas when it absorbs the particular wave length.—JAMES STOKLEY.

OVERCROWDING IN THE NETHERLANDS INDIES

MILLIONS of natives of Netherlands Indies are heading toward a serious internal situation, the result of overcrowding. So dense is the population of Java that the world's only agricultural areas rivaling this island's crowding are the Nile Valley, parts of the Ganges Valley, and some regions in China, according to a report in the Population Index issued by the School of Public Affairs of Princeton University and the Population Association of America. A 1930 census showed 817 persons per square mile, with 1,274 in the densest area. At the present rate of growth, by the year 2,000 Java, including its close-linked neighbor island, Madura, will be thronged with 116,000,000 people which the population experts flatly call "an impossible figure." Actually before that time, population increases will probably force down the living level, so that from bad living conditions rates of disease and death will rise. To forestall this misery, Dutch officials developed agriculture and industry until limits were virtually reached by 1930.

Inducing Javanese natives to colonize the less densely inhabited Outer Provinces of the Indies is the only other way out which officials have evolved. This colonization has the added merit, for the Dutch, of filling empty space, thus removing temptation from land-hungry Japan.

The seriousness of the situation is increased, the report points out, by the vulnerability of Netherlands Indies economy to changes in world trade. The richly endowed islands produce important quantities of rubber, tin, sugar, coffee, tea, cinchona for quinine, and other agricultural and mineral trade goods. But if trade demand falls, as it did during depression times, the islands are severely stricken.

"One hesitates to contemplate the situation," says the report, "if the extension of hostilities in the Far East should cut Java from Western markets, on which the actual lives of the natives depend."

THE HEALTH SITUATION IN EUROPE

EUROPE'S chances for escaping war-borne diseases this winter are not too bright. Like the prospects of famine, a hazardous health situation hangs on some vital "ifs." If this winter proves severe, as last winter was, fuel shortage will join forces with weather to promote disease. Supplies of fuel for household heat are expected to be even shorter than last winter. A mild winter would minimize misery from this cause, but cold waves would render people already weakened by malnutrition and other war experiences a ready prey to disease.

If health and sanitation services disrupted by war are not resumed, with sufficient medical supplies, there will be weak spots in health defense where trouble may spread. The speed with which French refugees are returned to their homes is important for health. Pneumonia and other respiratory diseases are rated as the chief risk which Europe's population faces, as conditions are now. Tuber-

culosis is likely to take heavy toll, if the work of careful organization is undone, and masses of people are permitted to spread the disease through overcrowding, and other poor living conditions. .

If Europe is acutely short of food supplies, as some observers claim, or if Nazi Germany will not share and apportion supplies equably, a train of well-known malnutrition evils is in store.

Another "if" in the food situation concerns transportation. Food *en route* from one area to another may be delayed or cut off by transportation breakdowns, all too frequent. If this occurs widely, due to fuel shortage or slowness to resume and repair transportation services, even food available will not be used to best advantage to nourish hungry people.

So far as epidemics go, this war has thus far—fortunately—failed to make sensational history. Typhus has been endemic in Poland and the Balkans. There is always some typhus in eastern Europe. The experiment in which several thousand doses of two new American-developed vaccines were given in Hungary and Rumania, to test their effectiveness as protection against the fever, has been hampered by political changes in Rumania. Since the area of Rumania where the tests were made has since become subject to Soviet Russia, the physicians in charge have presumably withdrawn. But in several months, a report of the effectiveness of the vaccines is expected to come from the Hungarian group.—EMILY C. DAVIS.

SCIENTIFIC MEN AND POLITICIANS

THE scientist is more honest in his work than is the politician because lack of morality in science is likely to destroy the experimenter, declared Dr. Harlow Shapley, director of the Harvard College Observatory. It is perversion of international morality, he believes, not of gadgetry, that has resulted in the epochal decay of present-day society. Dr. Shapley's statement was issued to explain the purpose of a Conference on Science, Philosophy and Religion to be held in New York on September 9.

"Morality in physics and chemistry is to some extent forced," he said. "The scientist, naturally, is as human in his irrationality as others. Survival, however, requires a kind of honesty. The unmoral experimenter poisons himself or blows himself up. If only a false economic doctrine, while still prenatal, would also electrocute its progenitor! Or an education schism backfire during fabrication and reduce its advocate to impotent illiteracy and confusion!"

A closer communion between the physical, psychological and social sciences was urged by Dr. Shapley as a means toward development for the social and psychological sciences of "a logical and rigorously experimental method similar to that which has brought such achievement in the physical sciences."

"The value of these methods," he said, "are well-publicized by the success of every-day tools. You rely on your electrical refrigerator, designed by the engineers; but you trust mighty little your politicians and diplomats. Thousands of people ride in automobiles with complete confidence in their mechanism. They worry not at all about the engine, reserving their anxiety for the unverified assertions of their congressman, for the economic system, for the treachery of man in fields where a forced morality does not exist. If we are to escape descent into darkness the scientist must join forces with other intellectual leaders, because on the advances in the educational, social and political fields does the advance of our science depend. The September Conference on Science, Philosophy and Religion is an effort in just this direction. Those of us who projected the conference hope that from it will come a better understanding between the different fields of learning that we represent, as well as a dynamic restatement of the rights of man and the democratic way of life."

ITEMS

DUTCH HARBOR, Alaska, felt the tremors of a strong earthquake shock on August 21, about 180 miles to the south, on the ocean bottom, the U. S. Coast and Geodetic Survey has informed Science Service. The survey's steamer *Explorer* was in Dutch Harbor when the quake occurred, and her captain, J. H. Peters, reported that as felt on shore the disturbance was of force four on the international earthquake scale: it rattled doors and dishes, but caused no destruction. Reports were received by wire and radio by Science Service from the following observatories: Georgetown University, Fordham University, St. Louis University, Pennsylvania State College, the University of Pittsburgh, the University of California, the Dominion Observatory at Ottawa, and the U. S. Coast and Geodetic Survey stations at Tucson, Ariz., and Ukiah, Calif.

RAGWEED pollen is scarce in the upper air over the ocean, but there are plenty of mold spores, which also cause hay fever, Oren C. Durham, chief botanist of the Abbott Laboratories in North Chicago, Ill., reported when the Bermuda Clipper landed in New York on August 22. Mr. Durham made the round trip on the clipper, exposing sticky glass slides to catch pollen grains, fungus spores, and whatever other particles might be adrift in the air. He examined them at once under a microscope on the clipper's cabin table. As the Clipper climbed over Long Island, he caught plenty of ragweed pollen grains, but after that there was no pollen, only mold spores. As the plane glided down to landing in Bermuda, and climbed for the clouds again, there were only traces of the spores, but at the 8,000-foot level of most of the return flight there were spores in abundance. No pollen was encountered until within 80 miles of the mainland, at 4,000 feet altitude. From there on in the slides were well spotted. Mr. Durham will next go to Yellowstone National Park by plane, to make studies of the pollens of that region (chiefly sagebrush) both at ground level and in the air. Following this, he will make a plane trip down the Mississippi, touching at St. Louis, Memphis and New Orleans. His final study for the season will be conducted at the Sun Valley resort in Idaho.