Radio to Bring Safety to Aviation

Radio—Aeronautics

Herbert Hoover Jr. Predicts its Compulsory Use

GOVERNMENTAL requirements for the use of radio on all passenger airplanes, similar to those in effect at present for ocean ships, are seen in "a matter of months" by Herbert Hoover, Jr., radio engineer with the Western Air Express, in a paper that he presented before the meeting of the Society of Automotive Engineers. Radio is essential to the continued success of air transportation, he said.

"Radio for aviation is a comparatively new thing," said Mr. Hoover. "It is true that two-way communication with planes while in flight took place as long ago as before the war, but the intensive application of it to commercial transportation is but a little over a year old. In this short period it has been necessary to develop apparatus of a type quite different from anything used before, to iron out all the difficulties relative to its installation and performance in airplanes, to install a complete system of ground stations, to organize systems for the rapid collection of weather information of an entirely new sort, and to develop a new technique of radio operation and control. In twelve short months aviation has had to go through twenty-five years of marine experience. I do not want to be misunderstood in saying that marine experience has not been of value in aviation, because it was shipping that provided the initial stimulus for radio development in its early stages. However, it has been the more recent research in telephone broadcasting and the amateur activities on short waves that have had the most direct bearing on aviation radio problems.

"The Airways Division of the Department of Commerce took the first step in providing ground stations for aeronautical use. About 40 stations have been installed or are being erected. They are dotted along the airways approximately 200 miles apart and cover the whole country from New York to San Francisco, and from Seattle to Key West. These stations use voice and have a carrier output of two kilowatts, giving them a conservative day range of 125 miles and a night range of approximately twice that.

"A band of wavelengths between 800 and 1200 meters was set aside for aeronautical purposes by the international convention in 1927, and it is within this portion of the frequency spectrum that the government stations are located.

"A new branch of the Weather Bureau has been built up to make hourly collection and forecasts of the weather, and the reports are then broadcast over the stations of the Airways Division. This service will soon be speeded up until the reports are gathered and broadcast every half hour.

"This service is of immense value to the aviation industry. It means that any flier, whether flying for sport or on regularly scheduled transport business, can now install a simple receiving set and, after eliminating ignition interference, receive the latest weather information almost anywhere in the country. The pilot need not know code, for everything is sent out by voice, and the actual manipulation of the receiver is as simple as any broadcast set in his home."

Wave lengths of 80 to 200 meters are the best of the shorter waves if a single channel is to be used, Mr. Hoover said, but they have the disadvantage that their intensity is greatly reduced at distances over 60 miles. At night they can be used for transmission up to 1200 miles. Shorter waves, from 45 to 60 meters, are much better in daylight for 150 miles or more, but at night, the "skip" effect prevents their use over shorter distances. This would require different wave lengths in day and night flying, but this also has its disadvantages, he said. It either requires the plane to stop and install a different set, or to have a switching device to change while in flight. "Both methods have their complications," he said.

"Shielding is the determining factor in whether or not radio is going to give us safer flying," declared Mr. Hoover.

"Each spark plug in the engine is a miniature radio transmitting station," he explained. "The ignition wires, magneto, low tension wires, and their associated parts form an antenna system. Every time a spark occurs across any of the plugs a radio impulse is sent into this antenna, and a corresponding signal is radiated out into space. Inasmuch as the wiring of the plane is not tuned to any particular frequency, the spark interference can be received on virtually any wave length from zero to infinity. Furthermore spark transmitters are famous for the interference they create, even when working into sharply tuned antennas.

"If it is imagined, therefore, that a highly sensitive receiver on the plane is trying to pick up a feeble signal from a station which is perhaps one hundred and fifty miles away, and only ten feet away are located from eighteen to seventy-two strong spark transmitters, feeding into an antenna which is radiating on all wavelengths, a fair idea of what ignition interference means can be visualized.

"There is only one solution—all of the spark plugs, the high and low tension wiring, the magnetos, the booster magnetos or coils, the switches, the starters, the generators, the batteries, and all of their associated parts must be continuously enclosed in a grounded metallic shield. The chief difficulty, in practice, arises in making an installation that will stand up under the continuous grind of transport service."

By Instruments Alone

NO modern airplane is thoroughly equipped which cannot be flown by instruments alone, declared Lieut. James H. Doolittle, who has taken off, flown and landed "blind" hundreds of times, before the National Aeronautic Meeting of the Society of Automotive Engineers.

"With the instruments now developed and readily available, it is possible to fly indefinitely without being able to see outside the cockpit," he declared. And Lieutenant Doolittle graphically told just how remarkable instruments function to launch a plane into the air, direct its flight and bring it safely back to earth again.

Experiments in flying by instruments alone were begun about a year ago in connection with the Guggenheim Fund (*Turn to page* 142)

How Your Adrenals Determine Your Character—*Continued*

normal amount of its hormone epinephrin. Lack of stimulus of the adrenal gland by warm tropical climates is one reason why the European is unable to adapt himself readily to life in the tropics. Another reason for this is given by the British scientist, W. Cramer, in a recently published book.

"There is a close chemical relationship between adrenalin and pigment. It has been shown that pigment can be formed from adrenalin and substances allied to adrenalin by a special ferment. . . . When owing to disease of the adrenal medulla or Addison's disease the formation of adrenalin is impaired, pigment is deposited in the skin. The pigmentation of the races living in tropical climates may perhaps be the method by which the organism disposes of the material which would otherwise have been used for the formation of adrenalin. In the white races this method of excretion of the excess of adrenalin of its precursor is not so well developed and this may be one of the reasons why white races are less fitted for a tropical climate," said Dr. Cramer.

The powerful hormone of the adrenal glands has been extracted in pure form, in fact this was the first hormone to be obtained in pure state. The work was done at the close of the last century and the beginning of this one. Professor John J. Abel of the Johns Hopkins University and Jokichi Takamine, a Japanese investigator, are the scientists chiefly responsible for the extraction and crystallization of this hormone. It has also been prepared synthetically in the laboratory.

Adrenalin has a wide use in modern medicine, though a drug, ephedrin, has been found to have similar properties and has replaced adrenalin to some extent in the treatment of asthma. Adrenalin acts to contract the arteries and so checks the flow of blood. Other uses are for relief of shock, as an aid in heart failure and in conditions of circulatory weakness.

Adrenalin has long been used to raise the blood pressure, particularly in cases of shock following severe injuries or operations, and because of its relaxing effect on the bronchial muscles it has been used effectively in treating bronchial asthma. However, to produce the desired effect, the adrenalin had to be injected directly into a vein, and for each fresh attack a fresh injection of adrenalin had to be made.

A new method of using adrenalin has been put forth quite recently by Dr. A. B. Luckhardt of the University of Chicago and Dr. Theodore Koppanyi of Cornell Medical College. These men have shown in dogs that adrenalin is capable of elevating the blood pressure even if injected beneath the skin, but they have also discovered the conditions under which the blood pressure elevating effect of the adrenalin injected under the skin may be elicited. They found that about fifteen minutes after the injection of adrenalin under the skin, when the injected area was gently massaged, there was at once a very considerable and protracted rise in blood pressure. It was even possible to produce blood pressure rises from such areas that had been injected twenty-four hours before the massage.

Dr. Koppanyi has lately shown that adrenalin injected underneath the skin with massage of the injected areas is just as effective in man as in dogs. In both cases the adrenalin forms a reservoir underneath the skin, the massage of which results in a blood pressure rise for over twenty-four hours. A New York surgeon, Dr. Howard Lilienthal, has shown that by using the method of Drs. Luckhardt and Koppanyi he could restore a patient suffering from traumatic shock.

Besides bronchial asthma, hives and hay fever respond very readily to adrenalin. It has heretofore been necessary for each attack of these diseases to be checked by a new injection of adrenalin. The method of massaging the injected areas does away with that very often inconvenient procedure, and during the course of a day or two only one adrenalin injection is necessary. The patient himself may be instructed to massage the injected area with a piece of cotton. Thus he will get the benefit of the full therapeutic effect of adrenalin. Clinical reports have already substantiated the effect of the massage of the adrenalin-injected areas in these diseases.

Invisible Flying—*Continued*

for Promotion of Aeronautics in fog flying. Although they showed conclusively that it is possible to land by instruments alone the procedure is still in a highly experimental stage and needs to be brought to a point where it is commercially applicable, Lieutenant Doolittle explained.

"When this is brought about," he said, "the airplane will become the safest known means of transport as it will be the only one than can operate unhampered by fog."

In flying "blind" in the tests, the take-off was made in the path of a radio beam with all instruments corectly calibrated and set at zero, the aviator said. Piloting by means of gyroscopic instruments, he followed the beam about four miles while the plane climbed 1000 feet. Then the plane was turned around and headed back into the beam.

"As the beacon, the source of the beam, was approached, the beam became narrower," he said, "and, while it was more difficult to follow, the course became much more exact. At the exact moment of passing over the beacon house, the reeds affected by the beam stopped vibrating momentarily and then began to vibrate in the opposite direction."

The beam was followed about four miles again in the new direction, a turn made and the field approached at an altitude of about 400 feet. As Lieutenant Doolittle was preparing to land, he took care to follow with the aid of the directional gyroscope, the exact center of the beam. An air speed of 60 miles an hour and a descent less than 600 feet per minute were assumed, both accurately indicated on the instrument board, because he had previously found that his plane would absorb the shock of hitting the ground at this speed and angle. The aviator read his altitude within 10 feet of the exact figure from an instrument for which varying air pressure was checked by radio from the ground. The actual landing was made at about 55 miles per hour and 400 feet glide per minute.

Lieutenant Doolittle's interest in flying began when he entered the air corps in the World War at the age of 21. He was the first to fly across the continent in a day, making the trip from Jacksonville, Fla., to San Diego, Calif., within 24 hours during 1922. In the fall of 1925, he won the Schneider trophy race in Baltimore. The difficult outside loop, performed by only a few daring pilots, has been flown by Lieutenant Doolittle, and he has been awarded the Distinguished Fying Cross.