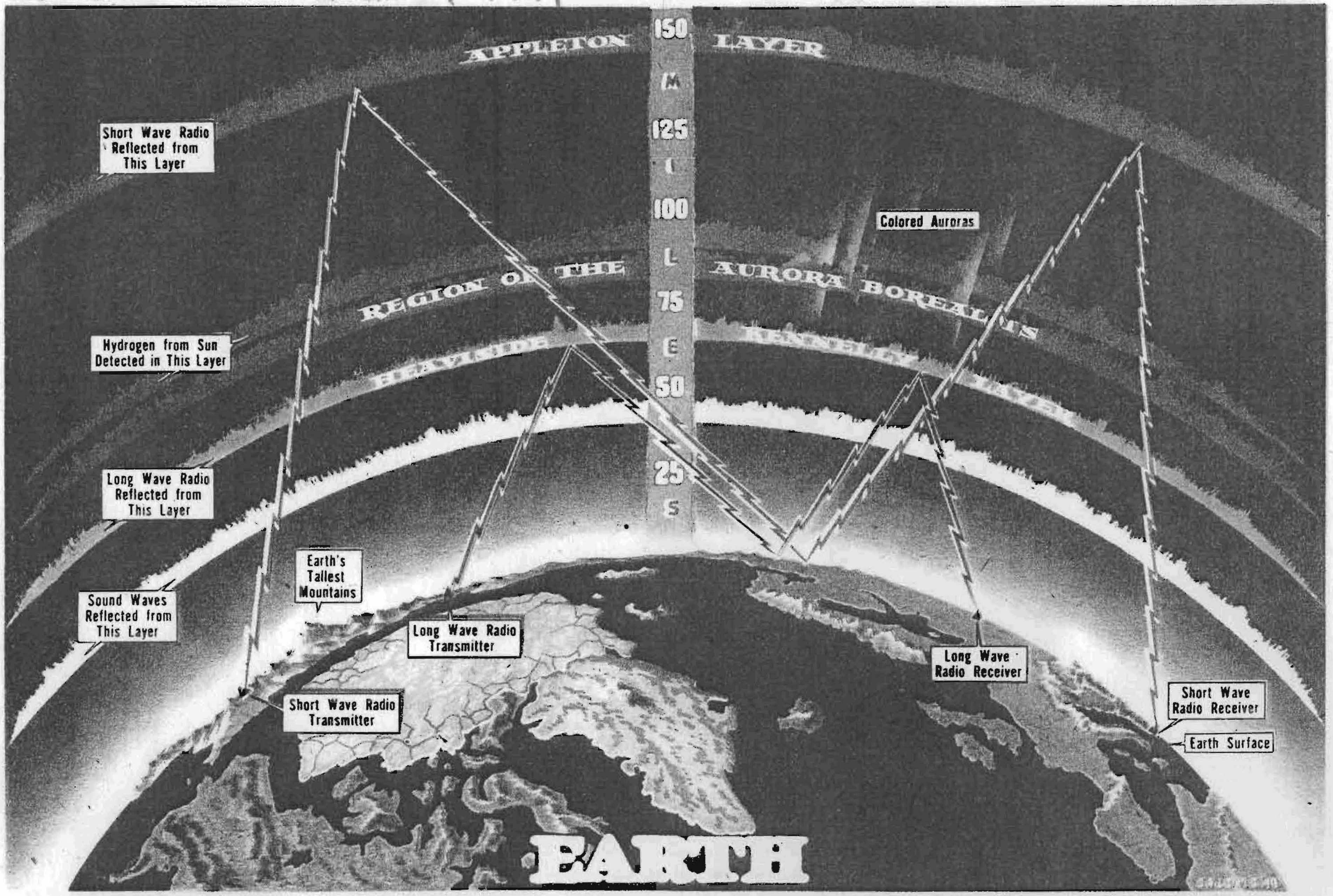

This illustration; an adaptation by William Sajovic of The Tribune art staff of a sketch by Jack T. Wilson, physicist, shows the nature of the upper atmosphere thru which impulses from the sun reach the earth, as described in the accompanying article. Distances in atmosphere are shown in exaggerated scale in illustration.

SOUND FROM THE SUN

SOUND FROM THE SUN

By JOHN A. MENAUGH

AS THE MASTER atomic machine of our own relatively small portion of the universe, the sun shines to provide light and heat, thus supporting life upon the earth. For thousands of years mankind has accepted this natural phenomenon as something to be revered or merely to be wondered about. Only a comparatively few have been curious enough to devote scientific study to the subject.

This scientific study, however, has paid off well in the wealth of data resulting from solar observations. Not only have the scientists discovered what makes the sun shine, but they have estimated how long it is likely to keep on shining, and what will happen to our planetary system when it stops shining.

It is pointless here to attempt to enumerate even an appreciable number of the many amazing discoveries made by the scientists in connection with their solar studies, since the chief object of this article is to discuss what may be one of the most astounding of all, the recent discovery that the sun actually talks. Its signals can be picked up in the form of sound, as a number of experimenters already have proved.

It whispers, it whines, and it whistles. It makes a sound like the falling of gravel on a tin roof. There is rarely, if ever, any stretch of time when its signals are not audible on earth to the scientists who are equipped with the proper instruments for receiving them.

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Among those fortunate enough to be on the receiving end of the 90-million-mile signal line is Jack T. Wilson, physicist of the engineering development division of the Allis-Chalmers Manufacturing company of Milwaukee, which operates not only the largest manufacturing plant in Wisconsin but seven or eight other large factories as well.

Wilson does not listen to the signals from the sun for mere entertainment, even tho he does enjoy it when the solar chatter is especially lively. The object of his studies is to determine the influence of solar radiation upon electric power line transmission. This is a subject of great importance to the company which employs him, as it manufactures, among other products, power distribution equipment, turbines, generators, and hydro-electric power plants. It seeks to be in the position to advise its customers on all problems pertaining to power transmission.

Wilson formerly was a professor of physical chemistry at the College of Emporia of Emporia, Kas. It was there, in 1931, that he began making his first solar observations. It was there that he carried on his first work with the coronagraf, a type of telescope equipped with a small mirror, which reflects to one side the image of the sun and permits the observation of the atmosphere of that body. The coronagraf, which in effect creates an artificial eclipse, was invented about 20 years ago in France by Bernard Lyot.

(Photo from Allis-Chalmers Manufacturing Co.)

Wilson manipulates directional concave disk antenna in connection with radio apparatus used in receiving impulses from the sun.

In 1945 Wilson went to a remote location in northern Manitoba, at the head of an expedition sponsored and founded by the Allis-Chalmers company to make observations during an eclipse of the sun. His object then, as now, was to study solar radiation as related to disturbances in power line transmission. Earlier in his career he had studied the effect of solar radiation on radio communication.

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In Manitoba Wilson set up apparatus to attempt to detect the presence in our upper atmosphere of hydrogen and helium from the sun. In this he was not successful, but recently it was announced by Dr. Carl Gartlein, professor of physics at Cornell university, that he had detected, by the employment of a spectrograf, the presence of atoms of the first named element in the upper atmosphere. Dr. Gartlein has not yet found helium atoms there, but those who are pursuing the study of solar radiation expect eventually to find helium. None of the scientists is optimistic about the possibility of finding in our atmosphere solar elements other than hydro-

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gen and helium. This is because of the great distance between the sun and the earth and the great amount of energy necessary to project other and heavier elements from the sun to the earth's atmosphere.

Altho failing to find hydrogen or helium in the upper zones of the earth's atmosphere Wilson did make an important discovery in Manitoba. His experiments there proved that the effect of solar radiation greatly influenced the electric charge carried in the earth's atmosphere. His observations showed a great variation in the electric charge between the time of the actual eclipse and the time when the sun was not obstructed by the moon.

Armed with this knowledge and also with an understanding of the nature of the world's upper atmosphere, Wilson has been in position to carry on his present laboratory work. In fact, his studies of sound signals from the sun are an extension of his experiments in the wilds of Canada.

It has been shown by experiments that the upper atmosphere, the zone called the ionosphere, contains a layer of ionized gas at a height of from 120 to 140 miles. This layer has a stratum in which atoms of oxygen and nitrogen have been bombarded by some external radiation source, electrons being knocked from the oxygen and nitrogen atoms. This was determined by sending radio signals into the layer of gas. Instead of passing thru the

(Photo from Allis-Chalmers Manufacturing company)

Dome or helmet type antenna, which is employed in making preliminary tests of sun's activities.

length, but are made up of many different wave lengths. They range in frequency from 150 to 3,000 megacycles, being in that part of the spectrum where radio and infra-red rays meet and are overlapping into each other.

"We can best understand the nature of this signal coming from the sun," says Wilson, "when we consider how microwaves and infra-red light are found in adjoining parts of the spectrum. The very short wave lengths received by special kinds of radio receivers are approaching heat waves in wave lengths, and behave in much the same manner as heat coming from any hot body which is radiating. The radio sets which are capable of receiving solar radio signals are really a kind of thermometer which measures the temperature of the sun, and on certain days when the sun's activity is very quiet such radio

those of the usual solar signals. He made this discovery, which was restricted at that time because of war security, in experiments conducted at Wheeling, Ill., just outside Chicago.

For the purpose of receiving the impulses from the sun that manage to come thru the layer of ionized gas in the upper atmosphere Wilson employs a microwave radio receiver with a specially built antenna, receiving only on the shorter wave length bands that are far below those of short wave radio and television. The signals that come in are detected in the form of sound, some like whistles, others like the dumping of a can of gravel on a roof. Usually the whistle is brief, but occasionally it is long drawn out. The most pronounced sounds are occasioned by the so-called bursts upon the sun, which have been shown

light, which covers the distance between the sun and the earth in about eight minutes.

The signals from the sun come and go on the receiving set that Wilson operates in his laboratory, some barely audible, others fairly loud in his ear phones. With a more sensitive receiver, such as the one at the bureau of standards, the signals, Wilson says, would register constantly.

Wilson is particularly interested at this time in determining how the loud sun burst sounds correlate with relay chatter in power transmission lines. As a result of his studies to date he has satisfied himself that some types of power line disturbances coincide with and are caused by bursts of impulses from the sun.

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Relays in the transmission lines serve a purpose similar to that of fuses in a household electric circuit. In other words, they are a part of a protective system to reduce danger when the current load is too heavy or when disturbances occur. These disturbances, often caused by impulses from the sun, as has been pointed out, agitate the relays, causing them to chatter.

It has been found, by moving receiving sets from one place to another, that in certain areas of latitude sun impulses are stronger than in other areas. Latitudinal bands exhibit greater or lesser disturbances, and the farther north in latitude the greater is the exaggeration of effect in power transmission.

For his observations in the field Wilson has a receiving set.

CRUISER

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valuable, it was said, with an amphibious force. It can shell the shore and prepare the way for landing troops.

Besides its nine fast firing 8-inchers, the Des Moines has a secondary battery of 12 dual-purpose, twin mount 5-inch guns, and an anti-aircraft battery of 20 dual-purpose, twin mount three-inch guns, plus twelve 20 mm. automatic machine guns.

The smaller caliber guns are intended primarily for anti-aircraft protection, altho they can be used against surface targets—dual purpose, in other words. The three-inch gun is another automatic fast firing weapon developed at the end of the war. It can fire more than 40 shells a minute—about twice the firing rate of the old hand loaded type used during the war.

The big Des Moines, now undergoing trials at sea, is the first of three super-cruisers the navy has ordered. Five others originally planned have been cancelled. The two sister ships are the Salem, to be completed this spring, and the Newport News, to be ready early in 1949.

The Salem and the Newport News will be air-conditioned to improve the crew's comfort and efficiency. The Des Moines, on the other hand, will have air conditioning only in the compartments near the hot engine rooms.

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An important engineering feature of the Des Moines is layer, some of the signals were reflected back to the earth, in the manner that radar signals are reflected back to the sending apparatus. In other words, this layer of ionized gas served as a barrier or partial barrier to the passage of the signals. Laboratory experiments have proved this. An extended program has been carried on by the navy and others to determine the most effective wave length to be reflected by the layer of gas.

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Experiments have been conducted by Dr. Donald Menzel of Harvard College observatory to show that the reflecting qualities of the ionized gas layer vary in accordance with the radiation changes of the sun. Already it has been disclosed that the layer of ionized gas behaves somewhat in the manner of an expanding and contracting lattice work, which opens and closes with the decrease and increase of radiation from the sun. When solar radiation is low in intensity the lattice work opens; when high in intensity it has a tendency to close. A large lattice opening permits radiation of long wave length to get thru, a small opening reflects back the long wave length.

As result of observations with the coronagraf it has become possible to predict what frequency of radio signal will be most efficiently reflected. This was of tremendous importance during the last war.

Impulses from the sun, according to Wilson, are not of a single or constant wave sets will receive only a background of noise, which may be attributed to the sun's high temperature.

"On other occasions, however, bursts of intense activity occur in certain spots upon the sun, which raise the effective temperature of the sun's surface in those localities to temperatures which may exceed a million degrees Fahrenheit. It is during these moments of such great excitement that the sun will radiate a radio signal which may resemble a high pitched whistle or the rattle of rain on a roof.

"The radio wave lengths coming from the sun travel in pulses, and the radio receiver is of such design that it reproduces the beginning and end of the pulse of the signal. This means that the pulse capsule, when put thru proper radio detectors, may come at such frequency as to be within the hearing range of the human ear while the actual radio signal coming from the sun is vibrating at such high frequency as to place it within the range of penetrating microwaves. Scientists now are becoming interested in the effects which these bursts of radio energy may have upon the reflecting layers of the upper atmosphere of the earth."

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It was in 1943 that Dr. Grote Reber, now with the United States bureau of standards, detected that impulses from the sun sometimes came in bursts of intensity far greater than to be related to blisters that appear on the sun's surface.

By visual observation with a telescope of the coronagraf type it has been shown that the burst sounds are of greater intensity when one of these blisters on the sun directly faces the earth and are of lesser intensity when the blister is at a greater angle from the earth. By watching the change in the position of the blister in relation to the earth it is possible to forecast when the burst will be received audibly by instruments on the earth. As the impulses lie in the same range as that of infra-red rays and are closely related to them it has been assumed that they travel at a speed approximating that of smaller than his laboratory apparatus but still sensitive enough to pick up the signals from the sun. He employs two different types of antennae, one resembling a concave mirror, the other dome-shaped and bearing metal rods that extend from the back of the dome. The concave antenna is particularly effective when aimed directly toward the sun. Both antennae were reconstructed from radar equipment according to designs by Wilson and his assistants.

Certain Canadian power companies as well as utility associations on both the east and the west coast have expressed interest in Wilson's solar radiation studies as a means of improving electrical power line transmission.

"I CAN'T STAND THE WAY SOME WOMEN TALK ABOUT OTHER PEOPLE WHEN THEIR BACKS ARE TURNED—TAKE THAT MRS. WEBB, AND, INCIDENTALLY, SHE'S 40, ALTHO SHE CLAIMS SHE'S 36, AND SHE'S BEEN MARRIED THREE TIMES—"

the installation of the ship's four turbine engines in separate compartments. This permits any of the four engines to drive the ship's four propellers if the others are damaged.

For the ship's crew of 1,500 to 1,700 men there are four barber chairs, a galley to feed all the enlisted men in a continuous cafeteria line, a soda fountain, tailor shop, and other accommodations.

The Des Moines also has a special cabin for an admiral who will use it as his flagship to command a division of cruisers.

Comparable in size with the famous Dreadnaughts of World War I., the Des Moines is smaller than the three 27,500 ton-battle cruisers of the United States navy, now in the "moth-ball" fleet—the Alaska, Guam, and Hawaii with their nine 12-inch guns each.

Germany's Gneisenau and Scharnhorst were in the 26,000 ton class and carried nine 11-inch guns each. The German Prinz Eugen, a heavy cruiser of 18,460 tons, had only eight 8-inch guns and 12 4.1 inch guns.

Some naval experts say that the Des Moines, despite its most modern guns, may be a throw back to a by-gone age when surface vessels fought it out with each other within visible range.

Aircraft have made surface combat obsolete. There is some question, according to these experts, whether the Des Moines' 8-inch guns would be used in shore bombardment in a future war.