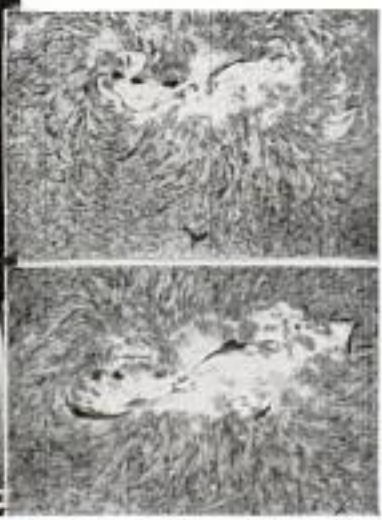
Left, melting a metal sheet with the aid of concentrated heat from a solar furnace

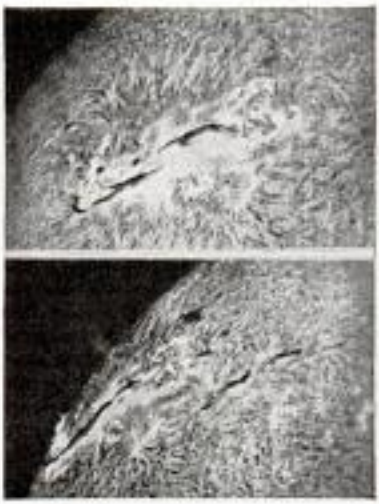


New POWER from

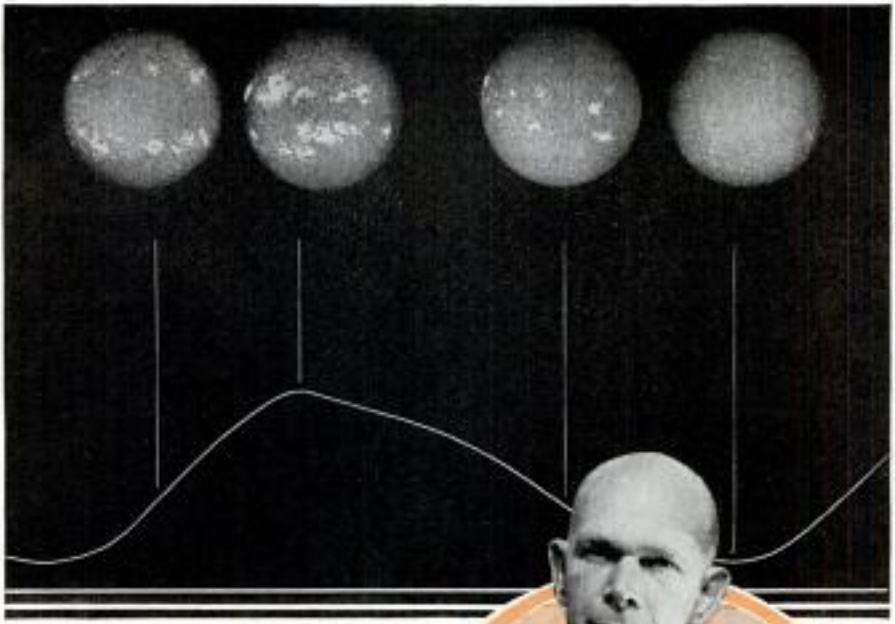
WILL man ever be able to transmit power by radio? Until lately science has had to reply emphatically that "on the basis of present knowledge" this was an impractical dream. Now it seems that eventually the sun may supply a different answer.

The reason is that during the last few months astronomers have learned more about an unexplained radiation that the sun broadcasts, and it may be that additional research will open up an entirely new field of knowledge. Mysterious radio interruptions are pointing the way.

The sun has been blamed for years for the peculiar "magnetic storms" that sometimes disrupt electrical communication systems. In a general way these disturbances are traced to sunspot activity. Not very much is known yet about the spots that appear on the sun, the belief being that they are regions on the surface that have a temperature 2,000 degrees less than their surroundings. Occasionally tremendous flaming clouds of hydrogen gas appear in the neighborhood of the spots. When these eruptions occur, electromagnetic disturbances are apt to happen on earth, but no theory that explains the connection has been generally accepted. Some radio experts think radio reception fades and improves in cycles lasting



Appearance of sunspot on successive days as the rotation of the sun carries it farther and farther to one side of the turning planet until it disappears from view



the SUN

Top, curve of sunspot cycle and spectroheliograms showing appearance of sun at different phases of cycle. Below, curved glass for solar heating and gas rising from sun's surface

a number of years, paralleling periods of sunspot activity.

Today a new connection between the sun and the earth is being studied. During the last year radio men have been surprised to find that at extremely high frequencies reception sometimes dies out completely even though reception at other wave lengths, including the broadcast bands, is not interrupted. Except for faint signals from near-by stations, short-wave

reception disappears as completely as if a fuse had blown. This happens at from seventy-five meters down past twenty meters, and depending on the wave length, lasts from fifteen minutes to four or five hours over the illuminated half of the globe.

With some exceptions the fade-out occurs about every fifty-four days. This period, being approximately twice the period of the sun's rotation, suggests that something is happening every other time the sun turns around, although no one can yet say why.

Top, studying sunspots on paper disk suspended in light path of solar telescope, and examining sunspots on glass negatives made with aid of telescope. Below, mirror disks of horizontal telescope used to study sun

Last spring scientists estimated a fade-out was due April 8, and astronomers decided to learn all they could about the phenomenon if it should recur. In California Dr. Robert S. Richardson, one of the "sun men" of the Mt. Wilson observatory of the Carnegie Institution of Washington, D. C., prepared a spectroheliograph to photograph solar eruptions by their hydrogen light and arranged other instruments for the test. When the work was over he had new evidence of some mysterious transfer of energy between the sun and the earth.

At 8:46 that morning the Mt. Wilson

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New Power from the Sun

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magnetometer registered an abrupt change in the direction and intensity of the earth's magnetic field. A magnetometer records magnetic fluctuations something like a seismograph charts the vibrations of an earthquake. Unlike the effect of an ordinary magnetic storm, however, there were no violent fluctuations of magnetic energy. At exactly the same minute, Dr. Richardson's photographs showed a large spot near the center of the sun suddenly erupted. A cloud of flaming hydrogen gas large enough to engulf the earth shot above the surface. Observatories in South America reported a similar phenomenon.

Checking up later, Dr. J. H. Dellinger, chief of the radio section of the bureau of standards, found that also at the same minute, short-wave radio receivers no longer picked up signals that had been coming in strongly a moment before. The effect was as if every short-wave transmitter in use had suddenly shut down.

"The indications are that this type of radio interruption is due to radiant energy emitted at the time of the sunspot eruption," says Dr. Richardson. "It seems to be a definite case in which a solar eruption is identified with an electromagnetic disturbance on earth, and shows that the energy that produced the radio fade-out traveled with the velocity of light.

"Instead of solving any problems, this example of energy transference only supplies new questions for which answers must be found. It does seem quite possible, however, that by additional study of the sun we will learn a great deal more than we now know about energy transmission and how to put it to practical use. It is impossible to be more specific because no one can say where the research will lead us, or whether results are five years or 500 years away."

Man has been trying to harness the sun for scores of years and some investigators think solar heat as a source of power may eventually enter the market in competition with coal and petroleum. It is estimated that solar energy falling on a square yard of surface at sea level on a clear day is equal to about one horsepower, although high losses in converting the heat are always encountered. One solar boiler that raised 210 pounds of steam per square inch and operated a pump of 1,400-gallons-per-minute capacity was built early in the century. Sunshine has been used to run stoves, water heaters, smelting furnaces and small motors. Several attempts have been made to set up huge power plants in desert regions to collect the sun's heat and convert it into steam, although no such scheme has been commercially successful.

Dr. C. G. Abbot, Smithsonian Institution head, who has experimented with solar power for twenty years, used a solar heater in California that stored boiling water overnight and that operated a fireless stove in which all ordinary cooking could be done. His heat-gathering device consisted of a glass-covered trough, the curved glass top of which focused sun's rays on a pipe through which a heavy oil circulated to the stove and water heating coils. Electrically operated gears turned the trough so it always remained pointed at the sun while that body was above the horizon.

Dr. Abbot's latest heat collector, far more efficient, consists of a large stainless steel curved mirror that reflects eighty per cent of the sun's rays to a small focus. At the focus the concentrated rays pass through the walls of several concentric glass tubes and heat a special black heat-absorbing fluid pumped through the innermost tube. Air spaces between the outer tubes are exhausted of air like a vacuum bottle so none of the heat will radiate away. The conducting fluid is raised to a temperature of several hundred degrees by the sunlight. The hot liquid, in turn, may be used to convert water into steam. A one-half horsepower steam-raising model is now under construction.

Many types of solar water heaters are used in sunny climates. In its simplest form a water heater consists of water pipes laid along the roof of a house to absorb heat from the sun. They may be connected to an insulated storage tank where the water may be held at a high temperature for as long as twelve hours. The roof pipes are usually painted black and laid against a black tar-paper background to increase efficiency.

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One development of the solar heater is a "sun-cooled" refrigerator for which a patent has been issued. The action of the heat is to boil off liquid ammonia, the ammonia in turn removing heat from hydrogen gas that circulates in a freezing coil. Even on partly cloudy days there is enough heat to operate the refrigerator.

Meanwhile, astronomers are learning more about the sun itself. That body is "burning up," or losing weight at the rate of 4,000,000 tons a minute, but the bulk of the sun is so huge that its loss since the earth was born is only a minute fraction. The sun is gaseous and rotates fastest at its equator. Spectra of sunshine show many materials not found on earth but these cannot be duplicated here because the high temperatures and pressures of the sun cannot be reproduced. Recent developments in photography have more than doubled the number of lines in the spectrum available for observation, and astronomers are studying "invisible sunshine" in the infrared band.

Most important of all, possibly, is the investigation of magnetism on the sun. Even the sunspots are magnetic and seem to have north and south poles like magnetized steel bars. Whenever spots occur in pairs they have opposite magnetic polarities. The north pole of one spot is reversed in its neighbor. Spots above the solar equator have opposite magnetic polarities as compared to spots below the equator, and the whole system of polarities reverses with each sunspot cycle. That means that the magnetic cycle of the sun is about twice its sunspot period, or about twenty-three years. New spots at the beginning of each sunspot cycle appear in fairly high latitudes and as the cycle progresses the spots occur nearer the sun's equator.

At present, facts like these have little practical value. Astronomers gathering the facts have not been able to arrange them into a sensible pattern that explains some of the peculiar things about sunspots. When they do accomplish this, they hope, they will have a new law of nature that can be put to work.

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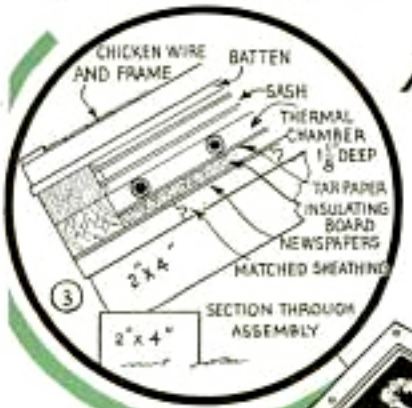
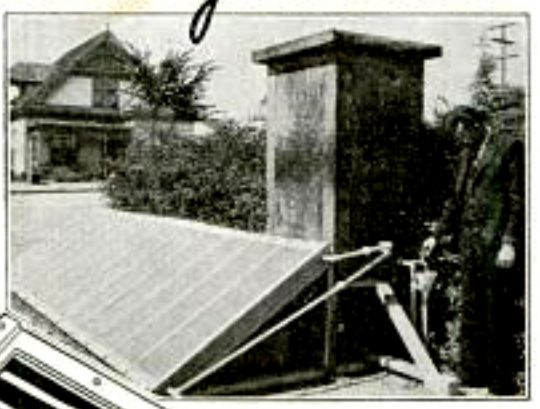
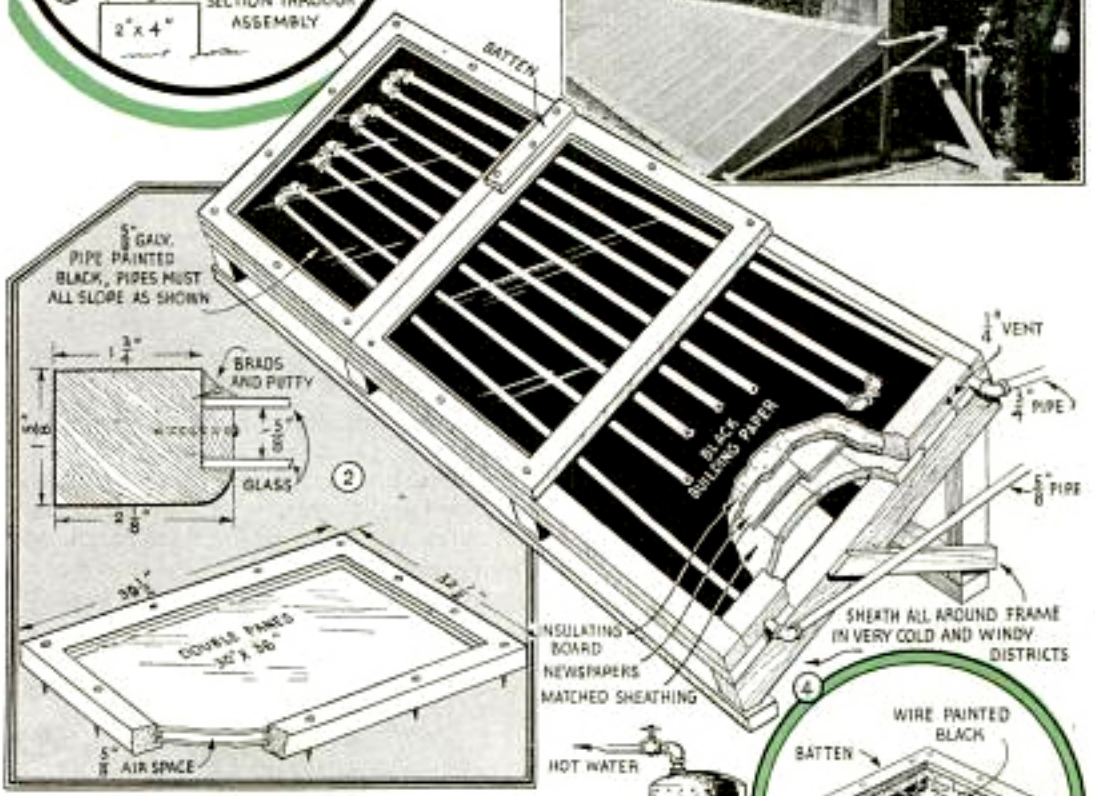
SOLAR HEATER . . .

reduces Gas Bills

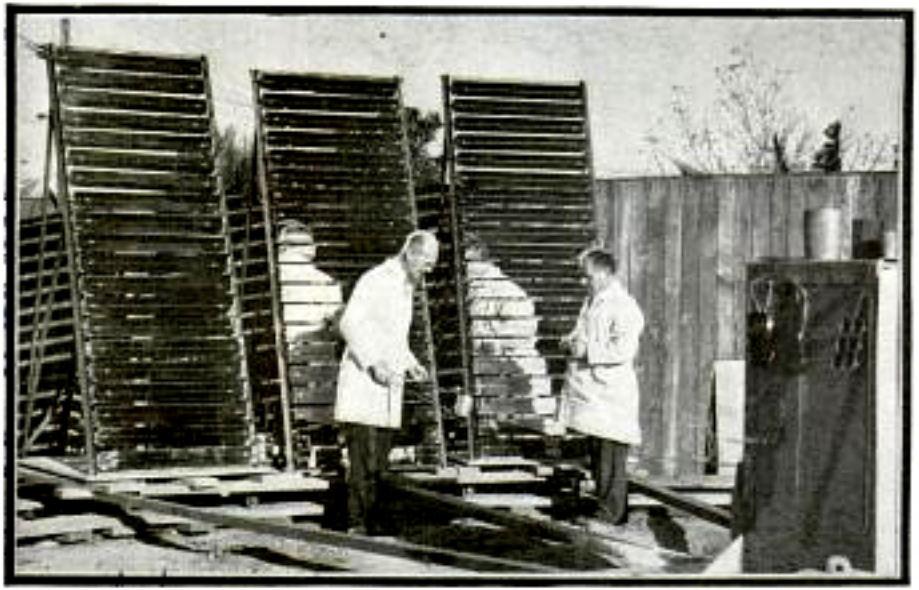






If located against the south side of your house, as close to the hot-water tank as possible, this heater will keep the water very warm when exposed to a fair amount of sunshine. The heater can be constructed easily and inexpensively, but the box, as well as the exposed pipes leading to the tank, must be well insulated to assure efficiency

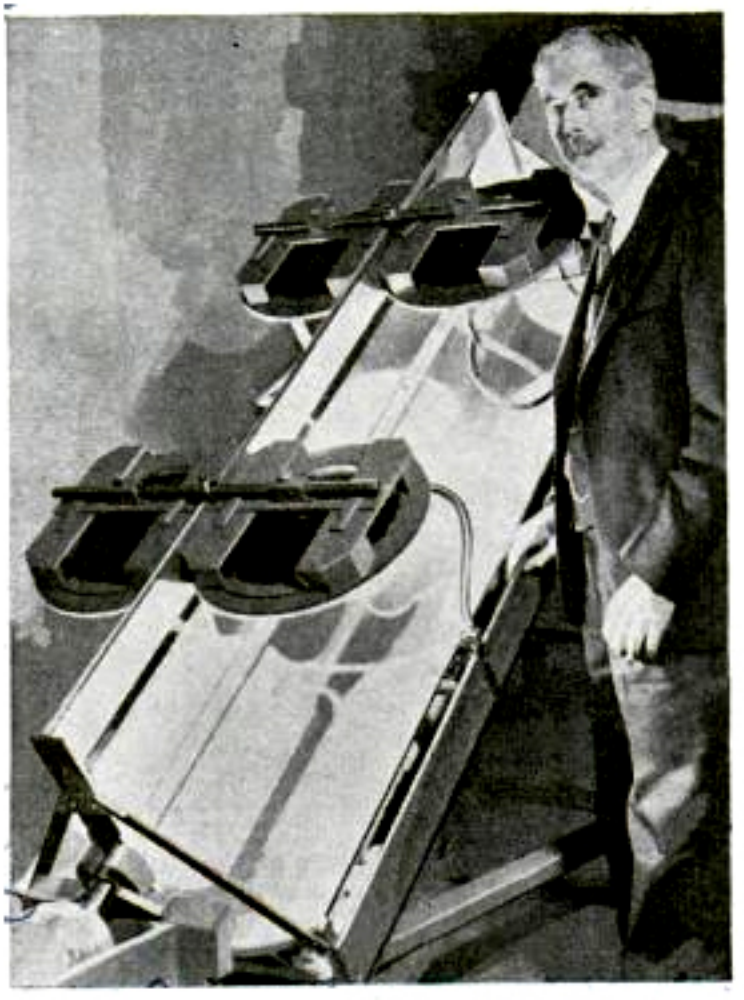
Superheat from Sun Developed by Mirrors



Sets of Mirrors with Which the Sun's Rays Are Focused to Produce Extremely High Temperatures; Heat as Great as 50,000 Degrees May Be Obtained in This Manner, the Inventor Claims

Holding a new hope for industry, a curved-mirror "furnace" concentrates the sun's rays and develops heat ranging from 1,000 to 50,000 degrees. Such high temperatures would be used to recover mercury from cinnabar, melt ore, superheat steam and to serve other purposes where extreme heat is required. While the solar furnace is still in the experimental stage, it has been subjected to exhaustive tests by the inventor, H. E. McCoy of California. The machine consists of a number of curved mirrors which focus the sun's rays on one spot.

Sun-Ray Steam Engine Hope of Cheap Power



Steam generator which is operated by heat of sun

Possible home and industrial uses are predicted for a steam engine designed by Dr. C. G. Abbot of the Smithsonian Institution to operate on solar energy. The engine is driven by steam produced by the sun's heat. Its designer believes that it may solve the problem of cheap power.

Sun's Rays Harnessed to Run Steam Engine

One of man's great ambitions—to harness the sun to a steam engine—has been achieved. Dr. C. G. Abbot, secretary of the Smithsonian Institution, has developed a solar heater and demonstrated that it would operate a one-half horsepower steam engine with sufficient efficiency for commercial purposes. The sun's rays are his fuel. Caught in three parabolic cylindrical mirrors of sheet aluminum, the rays are reflected in high concentration upon tubes of Pyrex glass. Passing through two concentric tubes of glass respectively one and one-fourth and seven-eighths inch in diameter, the rays reach a central one-half inch Pyrex tube which is metal plated on top and contains a black chemical, a chlorinated diphenyl compound to which a small amount of lampblack is added so that the liquid absorbs virtually all the sun's rays. Although liquid at ordinary temperatures, it still does not boil or flash at 662 degrees Fahrenheit. Between the concentric tubes a vacuum is maintained so that the heat of the liquid is retained. Superheated, this chemical is circulated through pipes to a boiler where it generates steam. Experimentally, this solar heat engine had an over-all efficiency of fifteen per cent in producing steam power. Dr. Abbot believes the time may come when, with coal and oil supplies dwindling, sun power may become essential. Even with the apparatus available today, he says, the sun can be harnessed for cooking, refrigeration, evaporation and small power plants. Ranches and communities in cloudless regions are manifesting interest in development of sun power.

Top, aluminum mirrors focus sun's rays on tubes containing liquid which absorbs heat, flowing through pipes at side to boiler where steam is generated. Left: Dr. Abbot and aides with solar heater

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