"That question is a good deal easier to ask than to answer," was the reply. "I have spent years in watching it and trying to learn something about it. I have discovered some things, but I should have to know a great deal more before I could adequately answer that question. I spent three years in the study of the spots on the sun before I was ready to make any announcements concerning them, and during the waking hours of those three years the sun's face was almost constantly before me. Have you ever looked at it in a telescope? Do you appreciate what watching the sun is? In the first place, the face of the sun in a telescope is almost always quivering. Our atmosphere makes it seem to move to and fro in waves, and looking at it is like looking at a flickering candle, so that if its surface were ever so near it would be hard to make out the details But then, it is. of course, really an enormous way off, so that these details are also lost from its remoteness."

"Can you give me an idea how far off it is?"

"I have tried in one of my popular writings to do that by a borrowed illustration," replied Mr. Langley. "For instance, you touch your finger to a candle, and in a fraction of a second your brain announces the pain The sensation has traveled along the nerve to the brain almost simultaneously, but the speed has been measured. Suppose you had an arm which would reach from the earth to the sun, and you could put the tips of your fingers on that glowing mass of fire It would be a little more than one hundred years (it you could live so long) before you could know that your fingers were being burned. Well, the rays of the sun have to come all that distance before they reach you, and the last miles of their journey are through waves of heated air, which makes the sun seem to flicker so, while beyond and behind all this almost all its brightest surface is in real actual motion, shifting here and there with a velocity many hundred times that of a cannon ball These real changes may last for a second or a minute, and special phenomena may occur in the twinkling of an eye In my studies of the sun spots I had to have a paper and pencil before me as I looked through the telescope to record these changes as they went on, in order to catch their varying expressions on the sun's face.

"I cannot describe to you the wonders which are going on there. I found, however, that in order to do my work well, I must learn something more than the mechanical drawing which was all I knew, and as these studies went on, I learned to draw and paint sufficiently well to make my records. Since then I have drawn hundreds of sun spots, and the works which I have published have been illustrated with my own drawings of them."

At this point in the conversation Secretary Langley had one of these former drawings of a sun spot laid upon the table. It was, in fact, a beautiful painting about 12x14 inches in size, of what seemed to be a snowy surface, with a large black area in the middle, crossed by strange lines of light, blending in fantastic outlines like the frost figures on a pane of glass.

"That," said he, "is a spot which I saw in 1873. It remained about twenty minutes in the field of the telescope, and it looks just as I saw it. You notice all around it is white. The sun does not look like a ball of fire when you see it in a telescope. It appears more frozen than hot. It looks much like the molten white iron in a great puddling furnace. You cannot see its beauty in the drawing, nor can you appreciate its size. That spot which I have there drawn was so big that the earth could have been dropped into it without touching the sides. Each of those bright gossamer-like threads is about 6,000 miles long, and that spot covered more than a thousand million square miles of the sun's face. It had an area five times that of the whole surface of the earth. A little edge of it broke up and dissolved while I looked at it, which was bigger than the whole United States. It was all in motion, and its seething particles were flying about at the rate of fifty miles a second along the surface under which I could see probably some thousands of miles into the darkness below, up from which came volumes of intensely heated whirling vapor."

"How could you look at the sun so long, Mr. Langley, without hurting your eyes?"

"I could not have done it," was the reply, "had I used nothing but my eyes. I had first to invent an instrument to take the place of the incomplete means used by Sir William Herschel in order to see the sun by reflection. The rays come to the focus of the telescope in blinding brightness, producing a heat sufficient to melt iron, but these rays have sides to them, and by mirrors placed at different angles they can be so reflected that there is no more heat and light than I choose to have. I have gazed at the sun for five hours at a stretch with this instrument, and have felt no more fatigue than I would have felt from reading a book."

"How about the heat of the sun, Mr Langley? Can you give me some idea of it?"

"Putting it briefly, it is enormous beyond conception, for there is enough to warm two thousand million worlds like ours, and every minute there is enough of the sun's heat falling on the earth to raise to boiling thirty-seven thousand million tons of water. But this heat which falls on the earth is not a thousandth part of one per cent of what the sun sends elsewhere, and all the coal beds of Pennsylvania, for instance, though they can supply the country for hundreds of years, would not keep up this heat during the one-thousandth part of a second. Now, when you think that these enormous figures are not exaggerations, but within the truth, you have to give up the idea of grasping the amount of the sun's heat as inconceivable."

"Will we ever be able to use this heat mechanically?"

"That remains to be seen. The force is there. The method of preserving and applying it economically has yet to be invented. My experiments on Mt. Whitney, in the Sierra Nevadas, showed that if we could save it all and use it for our steam engines it would give about a horse power for every square yard of ground. We hear a great deal about the immense power from the recent utilization of Niagara, but the sun power which is, so to speak, wasted daily on this little District of Columbia is hundreds and hundreds of times as great. The heat on the service of the Island of Manhattan or that occupied by London could at noontide drive all the steam engines of the world. So far there have been no practical inventions for utilization of this enormous power. At the Paris exposition of 1878 there was a reflector which drove a steam engine which worked a printing press. Ericsson made a solar engine which it was thought might be used in the pumping up of the waters on desert lands. The probability is that the day will come when we will use all this force. When it does the deserts of the world, with their enormous sun power, may become the great centers of manufacture and of civilization."

I next asked Mr. Langley some questions as aerial navigation. He was disinclined to talk about the subject, and he gave me to understand that the statements made by the press concerning him in this connection had been made without his authority. It is well known, however, that in his published scientific writings on aerodynamics Mr. Langley has described his discovery of facts which greatly alter our former supposed knowledge on this subject, and that though he has not there undertaken to describe any flying machine, as he is popularly supposed to have done, he has made experiments which show that mechanical flight is far from impossible. Thus, by a proper application and direction of the force and the speed, he has sustained solid brass plates upon the air with an incredibly small display of energy. He did this many years ago, and at Pittsburg he made thousands of experiments which show that there are certain shapes in which matter can be disposed so that the more rapidly it moves through the air in one sense, the less power it takes to move it, and that solid models can be thus made to skim, as it were, along the viewless air, as a skater skims along the surface of thin ice; the faster you go in either case, the less danger there being of falling down. As far as I could judge from my talk with him, his experiments show that the soaring birds have an intuitive knowledge of certain properties of the air, which have been only recently developed through these experiments, and that by these they navigate the air almost without effort in a way which there is no reason to think that it is impossible we can do, if not by our aided strength, at any rate by means of such engines as are recently being built. With regard to this he spoke of the fact that such birds even about Washington may be seen rising and falling, soaring up and sailing down, and moving in circles without any flapping of their wings.

Said he: "Did you ever think what a physical miracle it is for such a bird as one of our common turkey buzzards to fly in the way it does? You may see them any day along the Potomac, floating in the air with hardly the movement of a feather. These birds weigh from five to ten pounds; they are far heavier than the air which they displace; they are absolutely heavier than so many flatirons. I suppose if men saw cannon balls floating through the air like soap bubbles they would look on it as surprising, if not as a miracle. The only reason that we are not surprised at the soaring bird is that we have seen it from our childhood. Perhaps if we had seen cannon balls floating in the air from our childhood we should not stop to inquire how they did it any more than we do how the buzzards do it. I am speaking