warded to the warehouses, the largest slabs are cut into pieces of about three and a half feet in length, eighteen inches in width and ranging from one half inch to three inches in thickness. Drying and packing in bales weighing one hundred and fifty pounds each follows, and the cork is ready for exportation.

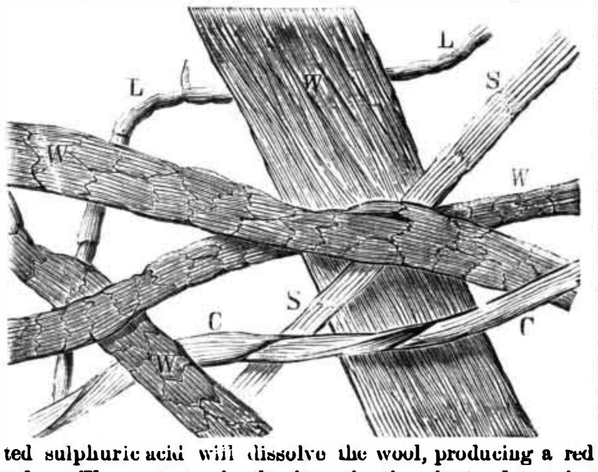
From five to twenty-five cents per pound is the usual price paid by the cork cutter in this country for the rough material as it arrives in the bale. It then undergoes another assorting, and a thorough steaming, in a chest designed for the purpose, the latter process softening the cork and rendering it easy to cut. To divide the substance special machinery is employed. Rapidly revolving circular knives are used, which cut by a drawing motion, as crushing strokes simply break the cork or cause it to crumble. The workman sitting in front of the machine places a piece of cork of suitable size in a revolving spindle by which it is firmly held. This spindle is raised a measured distance and the edges of the cork come in contact with the rotating knife, which smooths them off and leaves its work in a perfectly cylindrical form. Another method is to place the rough bits of cork in grooves on the circumference of a wheel which, working automatically, carries each piece to a point where its ends are received by a small lathe. The cork is then revolved slowly while a large circular knife removes a thin shaving, thus giving it the necessary taper, and a surface as true and smooth as if sand-papered. As fast as a cork is finished by the automatic lathe it is released and another substituted in its place.

Every portion of the material is utilized, either as stuffing for cushions or life preservers, or as a non-conducting substance for placing between walls or floors of buildings to deaden sound.

It has been estimated that it would require 4,000 men to be continually at work to supply New York alone with corks, if all had to be made by hand. There are at present 60 manufactories in the United States, cutting and supplying corks to the value of $2,250,000 per year.

TEXTILE FIBERS UNDER MICROSCOPE.

The present large demand for textile fabrics has led, not only to the discovery and application of new fibers, but also to several improved methods of disintegrating old rags that the fibers may be respun and used, either by themselves or in combination with new material. Wool thus treated is called shoddy, and its use has long been a common practice with makers of the lower qualities of woolen cloth. But as yarns are now spun for the making of mixed fabrics, wool, silk, cotton, and linen are so intimately blended that they all appear in the same thread, and a close examination with the microscope is necessary to detect the presence and the proportion of any of the four. Using a power of from 100 to 150 diameters, we observe, as in the engraving, the scaly hairs of wool, W, the smooth thread of silk, S, the cylindrical fiber of linen, L, or the spiral one of cotton, C, the colors of these varying considerably. When the presence of all or any of the four has been observed, a further test may be made by adding a drop of the ammoniate of peroxide of copper; by this salt, silk and cotton will be immediately destroyed, linen will gradually follow, and wool only will remain, its fibers being slightly increased in size. Concentra-



ted sulphuric acid will dissolve the wool, producing a red color. The next step in the investigation is to determine whether some or all of the fibers of the wool have been previously used. This is shown by the differences of the dyes, as the microscope enables the observer to discriminate between indigo, purpurine, madder, aniline, and any other dyestuff that may have been used, and worn fibers show traces of the bleaching to which they were submitted before being treated for a second process of manufacture. Another test for old fibers is the irregularity of their diameters, and the disappearance, in places, of the surface scales. A still further method of detection is the application of a lye of potash or soda, which attacks old wool with a rapidity to which new material is inaccessible.

To ascertain the proportion of old fiber in any mixed fabric, the threads should be laid as nearly parallel as possible. A power of from 20 to 50 diameters is sufficient to enable the investigator to count the fibers, the relative number of each being shown by the appearances above described. The chemical tests already mentioned will reveal at once the composition of the fabric to a careful observer. But there is obviously room for an improved method of distinguishing the different materials, and the importance of the interests engaged in the manufacture will probably induce the scientific world to bestow some attention on the subject.

TURPENTINE to be good should be as clear and white as water, of a strong penetrating smell, and very inflammable.

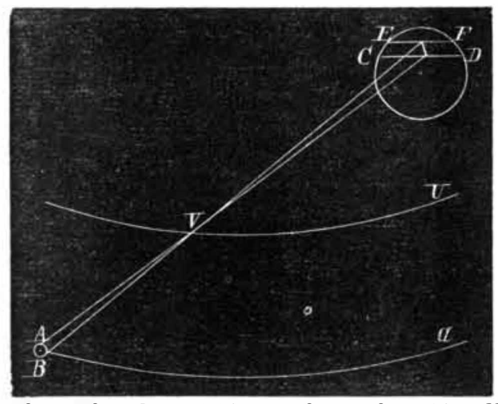
OUR PRESENT KNOWLEDGE OF THE SUN.

Professor C. A. Young concluded the annual course of lectures before the American Institute by an interesting and able discourse on the above topic. Modern science traces to the sun almost the whole range of terrestrial activity. We can easily follow out the solar action in our winds and no less easily in our waterfalls. The pumps that raise water to the hills are in the sun. The power that is expended in intercepting water in its downward flow is at the expense of solar fires. In a more remote way we may trace to the sun the steam power which is derived from fuel. The very force with which we move our limbs, the sound of our voices, even the power of mind, the impulses exerted in forming thought, in exciting emotions, are sun-derived, when traced to their ultimate source.

DISTANCE OF THE SUN.

The first point to be ascertained in relation to the sun, or indeed to any of the heavenly bodies, is its distance from the earth. The method of actually measuring the intervening space which can be most relied upon is by means of the transit of Venus. The planet will meet the eastern side of the sun's disk near the northern edge and will pass obliquely across. In Fig. 1, A and B represent stations on opposite

FIG. 1.



sides of the earth and *a* a portion of the earth's orbit. V is the planet Venus and *v* a portion of its path. C D and E F represent the apparent paths of the planet across the sun's disk. Fig. 2 shows the track of Venus more clearly. The upper and dark circle represents the planet as seen from the southern hemisphere, and the lower light circle, the planet as seen from the northern. The arrow shows the direction of the motion. The problem is to measure the distance between the center of the black dot on the great face of the sun to the edge of the latter with the utmost accuracy. An error of a hundredth part of a foot, at a distance of about 40 miles, would be fatal to any increase of the accuracy of our present knowledge.

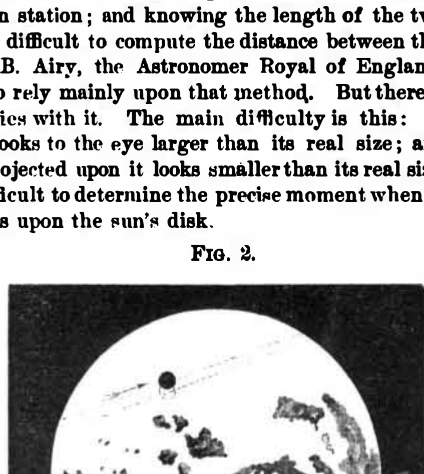
STATIONS ON THE EARTH.

The earth must be regarded as seen from the sun the moment when the planet strikes the disk of the sun, provided an observer on the earth were at its center. At that moment we must suppose ourselves transported to the sun, looking toward the earth. This will show the apparent path of the shadow of Venus upon the earth. Stations are selected around the edges of the world, all along in Japan, Kamschatka, Siberia, China and Siam in the northern hemisphere, and in New Zealand and some islands in the Southern Ocean.

METHODS AND INSTRUMENTS EMPLOYED.

In measuring this distance, there will be three different methods pursued. The old fashioned way was to note when the planet strikes the sun and when it leaves it, from which we may know the number of hours it takes to pass across the disk of the sun. Thus at the northern station we have the length of the chord which it passes over, and the same at the southern station; and knowing the length of the two chords it is not difficult to compute the distance between them. Sir George B. Airy, the Astronomer Royal of England, is disposed to rely mainly upon that method. But there are great difficulties with it. The main difficulty is this: A bright object looks to the eye larger than its real size; and a dark body projected upon it looks smaller than its real size, so that it is difficult to determine the precise moment when the planet enters upon the sun's disk.

FIG. 2.



Another method, which will be used mainly by the German astronomers, is to measure the position of this spot from time to time in reference to the edges of the sun's disk by means of the heliometer, an instrument by which we can measure very accurately the distance of the little round spot from the edge of the bright circle on which it will be shown. The other method, which will be used by all the nations, but will be mainly relied upon by the French and the Americans, is by photography. The English will use a common telescope, driven by clock work, with an eye piece to enlarge the image of the sun to about four inches in diameter. With this they will from moment to moment take photographs of the solar disk while the transit is going on, and they will afterward measure those photographs. The objection to this method is that the eye piece used to enlarge an otherwise too small image almost invariably produces a certain amount of distortion. The round image will not be round on the glass or paper, and it is very difficult to allow for that distortion. They propose to photograph with the same apparatus a scale of equal parts, putting up a board perhaps as long as this room, with laths nailed upon it at equal distances, to be photographed, and thus they propose to calculate, by comparison, the distortion of the different parts of the field of view. The Germans will use a telescope of the same kind and an eye piece of the same kind; but at the focus of their telescope they will place a piece of glass ruled with fine lines into squares. These will be measured beforehand very carefully, and the image of the sun and these ruled lines being photographed together, if there is any distortion it will affect these little squares precisely as it affects the sun; and they need only refer their measure to the nearest lines of this network to get an accurate result.

The best plan will be that pursued by the French and the Americans and by Lord Lindsay's party from England. The telescope will be 30 or 40 feet long—it need not be very large in diameter—and the image will be large enough not to require enlargement. Of course such a telescope would be very unwieldy if mounted in the usual way; and the method proposed is to put the telescope horizontally, perhaps in a tunnel underground to protect it from currents of air, though that is not essential, and to throw the image of the sun into the object glass by means of a flat mirror. In this case "flat" means a great deal. It is very difficult to make a mirror flat; and that is the difficulty in this method. The mirror must be so flat that at no point shall the curvature equal a radius of 18 miles.

NATIONAL EXPEDITIONS.

Russia will establish 25 stations in her Siberian dominions. France will send expeditions to Palestine, the Red Sea, Pekin and Japan, the island of St. Paul, New Caledonia, and possibly to the Sandwich Islands. The Germans will send to the Falkland islands, McDonnel's Island, and Kerguelen's Island, in the southern hemisphere. The English will send to Oahu, to Roderick's Island, to the Falkland islands, and to Alexandria, in northern India. Lord Lindsay will send a private expedition to Mauritius. The United States will

FIG. 3.

send out eight parties; four to Japan and China, and the other four to New Zealand, the Falkland islands, Van Diemen's Land and possibly Kerguelen's Island.

ILLUSTRATIONS OF THE SUN'S DISTANCE.

At present we consider the distance of the sun from the earth to be 92,000,000 of miles, with a margin of error of about 500,000 miles. It would take a railroad train 263 years to move from the sun to the earth; so that if the Pilgrim Fathers had started from the sun at the time they started from England, by a train whose only stopping places would be Mercury and Venus, they would not have arrived yet. It would take a cannon ball, going at full speed, about nine years to make the journey. Light takes eight minutes. Sound, if it could be carried over the celestial spaces, would be fourteen years on the way. You know, continued the lecturer, that if you touch a part of the body, one does not feel it instantly. If you touch the hand of any one with a pin, it will be an appreciable part of a second before he will feel it and draw his hand back. Now if I had an arm long enough to reach to the sun, and should put my fingers into the solar flame and burn them there, it would be one hundred years before I should find it out, and another hundred years before I could remove my hand.

DIMENSIONS AND DENSITY OF THE SUN.

Once having found out the distance of the sun, it is very easy to find out its diameter, which is about 860,000 miles. If the earth were represented by a ball 2¼ inches in diameter, the sun would require a ball of 18 feet in diameter, which would just about lie between this stage and the ceiling. If the earth were placed at the center of the sun, the moon would be so far inside the sun's surface that there would be almost room for another moon beyond, the distance of the moon from the earth being 240,000 miles, and of the surface