In this way threads can be produced of great length, of almost any degree of fineness, of extraordinary uniformity, and of enormous strength. A quartz fibre one five-thousandth of an inch in diameter Mr. Boys had in constant use in an instrument loaded with about 30 grains. It has a section only one-sixth of that of a single line of silk, and it is just as strong. Not being organic, it is in no way affected by changes of moisture and temperature, and so it is free from the vagaries of silk which give so much trouble. The piece used in the instrument was about 16 inches long. Had it been necessary to employ spun glass, which hitherto was the finest torsion material, then, instead of 16 inches, he would have required a piece 1,000 feet long, and an instrument as high as the Eiffel Tower to put it in.

There is no difficulty in obtaining pieces as fine as this, yards long if required, or in spinning it very much finer. Dr. Royston Piggott has estimated some of them at less than one-millionth of an inch; but, whatever they are, they supply for the first time objects of extreme smallness the form of which is certainly known, and therefore one cannot help looking upon them as more satisfactory tests for the microscope than diatoms and other things of the real shape of which we know nothing whatever.

Since figures as large as a million cannot be realized properly, it may be worth while to give an illustration of what is meant by a fibre one-millionth of an inch in diameter. A piece of quartz an inch long and an inch in diameter would, if drawn out to this degree of fineness, be sufficient to go all the way round the world 658 times; or a grain of sand just visible — that is, one-hundredth of an inch long and one-hundredth of an inch in diameter — would make 1,000 miles of such thread. Mr. Boys has made use of fibres one ten-thousandth of an inch in diameter, and in these the torsion is 10,000 times less than that of spun glass.

As these fibres are made finer, their strength increases in proportion to their size, and surpasses that of ordinary bar steel, reaching, to use the language of engineers, as high a figure as 80 tons to the inch. While these fibres give us the means of producing an exceedingly small torsion, and one that is not affected by weather, it is also true that they do not show the same fatigue that makes spun glass useless. A peculiar property of melted quartz makes threads such as these a possibility. A liquid cylinder, as Plateau has so beautifully shown, is an unstable form. It can no more exist than can a pencil stand on its point. It immediately breaks up into a series of spheres. This is well illustrated in that very ancient experiment of shooting threads of resin electrically. When the resin is hot, the liquid cylinders which are projected in all directions break up into spheres. As the resin cools, they begin to develop tails; and when it is cool enough, i.e., sufficiently viscous, the tails thicken and the beads become less, and at last uniform threads are the result.

Now, in the case of the melted quartz, it is evident, that, if it ever became perfectly liquid, it could not exist as a fibre for an instant. It is the extreme viscosity of quartz, at the heat even of an electric arc, that makes these fibres possible. The only difference between quartz in the oxyhydrogen jet, and quartz in the arc, is that in the first you make threads, and in the second are blown bubbles.

CULTIVATION OF SUGAR IN PERSIA.

THE sugar-cane was introduced into Persia from its original home in Bengal at a very remote period. The first indisputable mention, says the United States consul at Teheran, of sugar by a Western writer, is that by Moses Chorencrisis, in the fifth century, who describes the sugar-cane as he saw it growing on the banks of the Karun River, which joins the Shott-et-Arab at the head of the Persian Gulf. In the olden times, and as late as the fourteenth century, the sugar-cane was much cultivated in Susiana, the country intersected by the Karun River, and principally near Ahwaz and Jundi Shapur. Susiana was then one of the principal intermediate commercial stations between the present towns of Dizful and Shushter, and had its water from the Karun River by means of canals cut from the right bank some distance above Shushter, and from the Diz River by canals cut from the left bank, near the town of Dizful. With the decline of Jundi Shapur, in the thirteenth century, the canals were neglected, and the cultivation of sugar-cane necessarily ceased. The present Ahwaz is a small village of about fifty houses, on a mound which covers the ruins of a part of the former town. Hundreds of millstones or wheels, formerly used for squeezing the juice out of the cane, are lying about in all directions. Persian historians do not ascribe the ruin of Ahwaz to the failure of the water-supply, but to scorpions. They say that an Indian merchant, with the view of raising the price, bought up all the sugar he could, and stored it for a year or two. When he opened his stores, all the sugar had turned into scorpions. Millions of scorpions came out of the sugar-store, all the inhabitants of Ahwaz fled, and the city has remained a desert from that day. There is still current in Persia a proverb which says, "At Ahwaz sugar-cane produces scorpions;" and one of the Persian poets, referring to the ringlets of his mistress, says, "They are as deadly as the scorpions of Ahwaz." The only district in Persia where sugar-cane is now cultivated is Mazanderan, which is the principal rice-producing district, and it was probably introduced during the last century. The sugar-cane in Mazanderan requires twelve months to ripen; but the canes are small and poor, few being ever found thicker than a man's finger, and the produce is of very inferior quality, being dark and moist. Both of these defects in all probability arose from want of skill in the cultivation and preparation of this valuable plant. The sugar is mostly consumed in the province; a considerable portion, however, is exported to Gilan, and some to Russia. The canes are planted in slips with two or three joints, in February or March, and ripen about eight or nine months after, having then a height of about five feet. One mill turns out per day about 200,000 pounds of juice, and about 60 to 70 pounds of sugar. The juice, therefore, yields 30 to 35 per cent of sugar. Only raw sugar is manufactured in Mazanderan. There are no sugar-refineries. The raw sugar is sold at the place of manufacture in the villages at from three farthings to a penny a pound, and in the markets of Sari and Barfunish at from a penny to twopence a pound, according to quality. In some towns of Persia, principally Yezd and Ispahan, Jaru raw sugar was, up to a few years ago, refined, and made into loaf-sugar. The loaf-sugar made in Persia was seldom perfectly crystallized, and was on that account very soft; it was also more or less impure and dirty, the loaves not having been properly washed, and the green sirup not having been completely removed. The imported loaf-sugar becoming very cheap, sugar-refining in Persia ceased to be profitable. The general Persian word for "sugar" is *shakar*, "the sugar-cane" is *udi-i-shakar*, while "refined sugar" is *kand*, "a loaf of sugar" is *kelleh-i-kand*, "sugar-candy" is *nabat*. Persia is famous for its sugar-candy. This is made in the ordinary way, but is left to crystallize on strings in a bowl of earthenware or china. The strings are kept at the bottom of the bowl by a piece of lead, and at the top by strips of wood. When taken out of the bowl, it retains its shape, and is called *kasch-i-nabat*; i.e., a bowl of candy. Consul Schindler is of opinion that sugar-cane would thrive well in some districts of Persia and southern Persia, at altitudes of from 1,000 to 3,000 feet above the level of the sea. The plain of Bugh-i-Mailik, east of Shushter, at an elevation of 2,600 feet; that of Shapur, west of Shiraz, elevation 2,500 feet; those of Fihift and Rudbar, south of Kerman, elevation 2,500 feet, — appear to him to be eminently suited to the cultivation of the sugar-cane.

FRUIT-CANDYING INDUSTRY OF LEGHORN.

THE English consul at Leghorn says that that city occupies the first place in Italy, and perhaps throughout the Mediterranean, for the preparation of the candied citron and orange peel so largely used in all branches of confectionery — citron being brought for this purpose from Corsica, from Sicily, from Calabria and other southern provinces of Italy, from Tunis and Tripoli, and even from Morocco; while the candied peel of the fruit is exported to North America, to the United Kingdom, and to Hamburg for distribution throughout Germany. Sugar also is imported for the purpose of the manufacture from Egypt. The wood of the boxes in which the candied peel is packed comes from Trieste, and the immense earthenware vessels necessary for the saturation of the fruit in