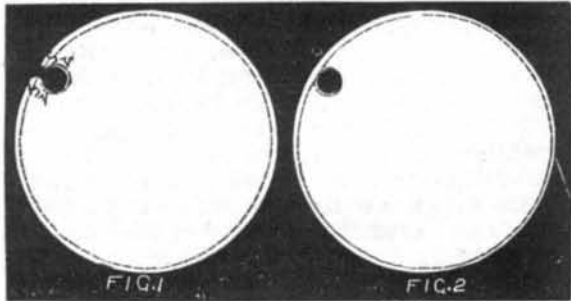


AN AUTOMATON TRANSIT OF VENUS.

The Astronomer Royal has recently designed and constructed a working model to show the phenomena of the transit of Venus, of a peculiarly complete and simple character, which we show in Fig. 3. A few words only are necessary to enable any of our readers to appreciate its object and scope. A transit of Venus occurs only twice in about 120 years; and hence the importance of observing this phenomenon. The feature to note is the exact instant at which the edges or limbs of Venus and the sun are in contact during the passage of the former across the disk of the latter.

Very great difficulties have been found on the occasion of



previous transits in obtaining reliable observations, owing to the peculiar optical effects accompanying the phenomenon and the consequent difficulty in insuring the observation of the same particular phase in the transit by all observers, as well as the doubt arising from the exact effect of the peculiarities of each telescope and each observer. So great indeed have been these difficulties that the observations of the transits that have hitherto taken place—observations made at great trouble and expense—have been found of very doubtful value. It is, therefore, most important that uniformity in habit of observation should be acquired by all the officers and others leaving England to observe the transit of Venus in 1874. To this end systematic practice of some kind is desirable. How is this to be obtained with a phenomenon occurring only twice in 120 years? Careful observations of the transits of Jupiter's satellites have been recommended, but Sir G. Airy has met the difficulty by a device which appears to give a singularly close copy of the transit of Venus, and on which observers may try their power to their heart's content. Before giving a description, however, it is well to understand the difficulty to be dealt with in the observation of a transit of Venus. Fig. 1 represents the sun with Venus coming on to it about the moment of internal contact. There is a ligament connecting the black disk of Venus with the sky at the point of contact. This ligament is the main cause of the trouble. It is nearly, if not always, seen, and is explained in the following way:

Any brilliant object dazzles the eye, and by irradiation appears to be larger than it really is; thus, in Figs. 1 and 2, we suppose the real size of the sun to be indicated by the dotted line, while the apparent disk is the size of the larger circle. So again Venus should be seen the size of the small dotted circle, but the sun so far encroaches on her that she only appears to be the size of the black disk whenever her edge is seen against the sun. But up to the moment that the entire edge of Venus enters within that of the sun, the light cannot encroach at the part that, as yet, is not projected against the sun but only against the sky. Consequently, the limb of Venus that last enters on the sun's disk is for a time seen its full size; and the light, as the limb of the sun concealed by it, can neither encroach on the sky nor on Venus. In short, at this point the edges of Venus and the sun are those shown by the dotted circles, and thus the black sky and black disk of Venus meet where the circles, *s s* and *v v*, meet, and thus the ligament is formed. It has been supposed that directly Venus enters within the sun's disk, as shown in Fig. 2, the light rushes in and encroachment takes place. Supposing this to occur immediately after internal contact, it is clear that, when understood, the peculiarity of the phenomenon would greatly facilitate its being accurately observed and recorded. It is clearly necessary, however, to ascertain the truth of this supposition.

Fig. 3 shows the apparatus designed by Sir G. Airy to represent the transit of Venus, at which the officers and other observers now practise. A glass slide, *A A*, with a black disk (to represent Venus) fixed on it, is drawn by clockwork across the opening, *S₁ S₂*, cut in a screen. The curves, *S₁* and *S₂*, correspond to the limbs of the sun at the moments of ingress and egress. By means of the looking glass, *D*, the reflected beams of the sun are thrown through the opening, *S₁ S₂*, and the result is that the phenomena of encroachment of light and ligament, or "black drop," is seen in an actual transit. The rate of motion and size of Venus are calculated so as to give the same apparent dimensions and movement when seen on the main building by observers on the top of the magnetic buildings in the Royal Observatory, Greenwich, as those of Venus at the expected transit. The limbs of the

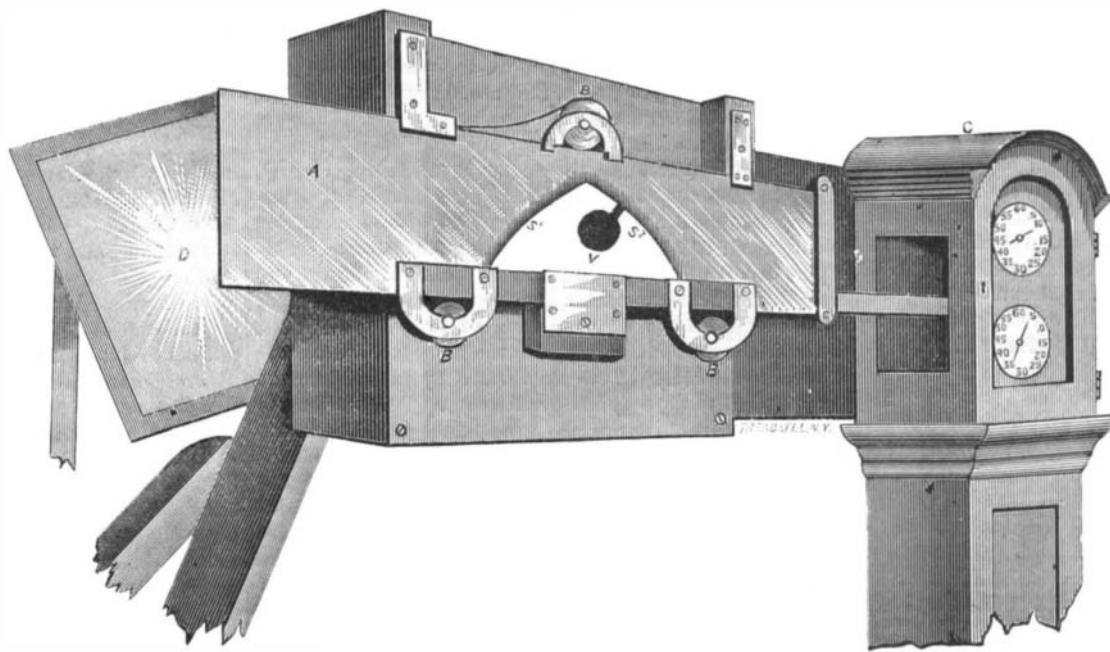
sun are brought together and make an arch, in order to give ingress and egress without unnecessary loss of time. We have said that our observers are practising daily at this model, and it may be expected that their personal equations and the effects of peculiarities in telescopes will be clearly established. We may add that some rather unexpected facts have come out, which seem to indicate that a modification of the generally received explanation of the behavior of the black drop, which we have given above, may be necessary. For example, it is found that with a smaller telescope Venus is seen to leave the limb and enter within the sun's disk later, and come in contact again at egress earlier, than with a larger glass. Then, again, it is found that, with a brilliant blaze of sunlight, a ligament is seen in a position when with a faint light it would have disappeared. This is rather contrary to the generally received ideas. It is premature, however, to say much now. A few weeks' work may establish very valuable results.—*The Engineer*.

RECENT GEOGRAPHICAL NOTES.

During the past year, MM. Stuebel and Reiss have explored the Andes of Ecuador, and ascended Mounts Chimborazo, Aetar, Cotopaxi, and Tunguragua. Among the volcanoes of the chain, three exhibit especial characteristics and only one, Pichincha, retains a moderate activity. We note no especial results of the labors of these explorers, beyond the determination of the altitudes and physical characteristics of the mountain range, and certain trigonometric calculations or observations having for their object the completion of accurate maps of the country.

H. B. M. ship Basilisk has taken possession in the name of the Queen of England of the western coast of New Guinea. This great island is peopled by a long haired black race known as Papous, and is said to be very fertile. The Basilisk explored the coast for a distance of 140 miles and discovered the bay of Youl, to which the name Port Moresby was given. A channel was also found, which, it is believed, will materially improve the route now followed by steamers between the Asiatic and Western American coasts.

There exist in Copenhagen and Moscow remarkable ethnological museums. That in the former city is comprised of forty rooms, in which are exhibited, all the objects and documents relative to the arctic regions. The Moscow museum has sixty wax figures showing the different races existing in the Russian Empire, of which thirty represent types found in European Russia and the Caucasus. The comparison of the contents of the two museums has recently led to a discussion regarding the Ainos, a race now inhabiting the Saghalien Yesso and the Kurile Islands. M. de Quatrefages states that the people once formed a great nation, which extended itself over the Indian Archipelago, conquering the country and founding the present Japanese



AUTOMATON TRANSIT OF VENUS—Fig. 3.

Empire. The Japanese, however, soon became a distinct race, through intermarriages with the Chinese, and the Ainos gradually disappeared, until only a remnant of the pure stock now exists. They clearly belong to the Caucasian division of mankind, and are also believed to be the progenitors of the Esquimaux of North America.

Dr. Nachtigal, a German traveller, at present engaged in exploring central Africa, has been recently heard from. He has traversed the shores of Lakes Tchad and Chosi, and arrived at a capital city called Abon-Cheu. The inhabitants are violent, quarrelsome, and intemperate, hating strangers, and only ruled by the tyrannical power of their sultan. The commerce consists in slaves, ivory, and ostrich feathers, and flows mainly to Egypt.

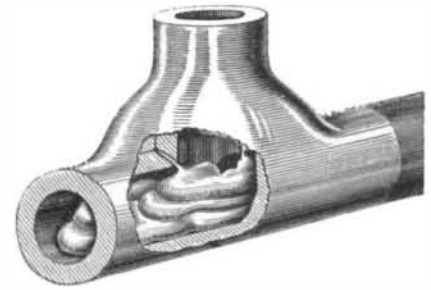
M. Delesse announces the discovery of new silver mines at Caracol, near the frontiers of Chili and Bolivia. Sulphides and sulphates of silver are found associated with argentiferous lead. The mines were found by Frenchmen, and a capital of thirteen million dollars is to be raised for their exploration.

J. W. writes that 400 men were killed in the State of New York, in seven months, while coupling cars.

CARELESS PLUMBING.

We should advise such of our readers as are plumbers to cut out the accompanying little engraving and post it in a conspicuous place in their shops, so that all their journeymen may have it constantly before their eyes. It indicates about as disgraceful a botch as any mechanic who pretends to the smallest degree of intelligence could hope to accomplish.

The piece of piping represented was recently removed from a building, situated in this city and owned by a gentleman with whom we are well acquainted. For some time past, continual complaints have been made by tenants of a



failure in the proper water supply. An experienced mechanic was set to work to discover the trouble. After exhausting his ingenuity in trying to remedy the defect, he finally concluded that the main pipe was too small, so a larger connection was laid at great expense; still the difficulty continued. It was finally determined to cut away the joints of the conduits through the building. This was partially done, when the piece shown in our engraving was removed, and the cause of the trouble at once made apparent. The individual who mismade the joint (we cannot do violence to our feelings by calling him a plumber) carelessly fitted the connection to the larger pipe, and by so doing allowed his solder to fall into the bore of the latter, choking it up almost completely. The fragment is now before us; and estimating the pipe to be about 3/8 inch originally in internal diameter, it is evident that the solder has reduced it to an opening of probably barely a tenth of an inch.

It occurred to us that doubtless many of our readers are experiencing difficulty with the water arrangements of their buildings, and vainly seeking just such a hidden cause as this; hence we have had the annexed engraving made in the hope that it may serve as a suggestion of value. In any event, it will do for a warning to plumbers to be careful in soldering pipe joints.

A Tower Taller than Babel.

Messrs. Clarke, Reeves & Co., proprietors of the Phoenixville Bridge Works, Philadelphia, Pa., propose to construct a wrought iron tower, one thousand feet in height, to be completed for the American Centennial Exhibition in 1876. The tower is to be circular in section, one hundred and fifty feet in diameter at the base, diminishing to thirty feet at the top. It is proposed to have spiral staircases winding around the center tube for those preferring to walk up; but elevators will be provided, which are calculated to ascend to the top in three minutes. We have in process of engraving a full page illustration, representing the tower in contrast with St. Peter's Cathedral, Rome, St. Paul's Cathedral, London, Bunker Hill Monument, the Pyramids of Egypt, and other existing tall structures, all of which, alongside of the thousand feet tower, look like pigmies.

This is one of the greatest engineering projects of the age, and it is in the hands of constructors capable of completing whatever they undertake. The beautiful engraving we are having executed will be ready for publication in the SCIENTIFIC AMERICAN within about two weeks. We calculate that it shall be the handsomest wood engraving that has appeared in any American newspaper. The copy of paper containing this engraving will be worth a whole year's subscription.

Frigorific Effects of Capillarity and Evaporation.

By directing upon a sheet of spongy paper, wet with bisulphide of carbon, a spray of pure water, hoar frost is not formed; but if the conditions be reversed, and the bisulphide applied in a finely divided spray, (according to M. Décharme) a circle of arborescence becomes quickly apparent. The same jet, directed on the bulb of a thermometer, produces first hoar frost and then arborescence, together with a lowering of temperature from +50° to -7° Fah. Arborescence thus formed upon a glass plate may be retained long enough for examination by the microscope. Other liquids which are capable of producing similar effects to bisulphide upon spongy paper are chloroform and rectified sulphuric and bromhydric ethers. The icy arborescence is believed to be purely aqueous. Its point of fusion corresponds exactly with 0° C. (32° Fah.), and it has no taste or odor after the evaporation of the volatile liquid with which it is impregnated.