adjusted, by moving the plates perpendicular to one another and by altering the distance of the plates from one another, this so-called “ travelling mark ” can be placed on any point of the landscape, and then used for the measurement of solidity of the objects, or the production of plans and models, just as formerly, for example, the measuring staff was used for geodetic observations, with the difference that in the stereocomparator the mark is regu­lated by the observer only and is not hindered in its movements by any undulations, &c., of the land.

Fig. 13 shows how the lateral movement of the mark m2 is trans­formed in a movement towards and away from the observer in the three-dimensional image Μ. Fig. 14 shows the theory of measuring a stcreophotograph. The axes are horizontal when the photograph is taken, and the plates are in one plane. It shows the method of calculating the position of the point P in the object-space from the co-ordinates *x1* and y1 of image-point on the left plate and the so-called parallel axis *a=x1-x2;*the last is constant for all points in the vertical plane GG through P at right angles to M1O1. The two microscopes in fig. 14 really produce erect pictures, and the two plates are so placed in the stereocomparator as to be seen from P1' and P2'.

The use of the stereocomparator is unlimited for the measure­ment of relief. It is extended similarly to all objects and phenomena, large and small, distant and near, in motion or stationary, to those which retain their shape for a long period or which are constantly changing, or to those which are only visible for a short time. For a large number of experi­ments of this sort—mountain photography (Von Hübl, &c.), coastal measurements, photographing a battle from a ship, geodesy, study of the waves (Konlschütter, Laas), the trajectory of a shot (Neuffer, Krupp, Neesen), the use in building railways or on voyages of discovery, &c.—the stereocomparator has given proofs of its uses and new fields are being constantly opened up for it. A further advance has been made in the stereophotogrammetric method by providing the stereocomparator with a drawing apparatus (F. V. Thomson, E. v. Orel and Carl Zeiss), with which contours can be automatically drawn from the stereophotogrammetric photo­graphs. E. Deville’s (1903) stereo­planigraph (fig. 15), designed for the same purpose, is only used as a demonstration apparatus. The mirrors are transparent for the observation of a source of light, &c., which is moved in the object-space.

The stereometer may be regarded as a modification of the stereo-comparator, and is constructed for the measurement of men and animals, and also for sculpture, and for the observation of complete stereoscopic photographs. The motion of the mark is effected by a lateral movement of one of the two objectives forming the picture. Pulfrich has recently provided the Greenough binocular microscope with a point or a circular mark situated exactly in the centre of the field of view for the purpose of the direct gauging of small prepara­tions which cannot be directly brought into contact with a mark. This contact with the preparation is effected by displacing either the preparation or the microscope, and the separate distances are read with a vernier.

The earlier suggestions for making the stereoscope a measuring instrument were not realized though decisive improvements were made. Brewster was unconsciously near the solution of the problem when he prepared ghosts or vistas by placing one transparent picture over another. More important than these trivial pictures are the superposed pictures (of conic sections, machines, anatomical preparations, &c.) contrived by E. Mach (1866) in which sections of the same solid object are successively photographed on one plate so that in a stereoscope one can see, as it were, through the opaque surface of the solid into the interior. To A. Rollet (1861) is due the merit of constructing the first stereoscopic measuring scale. It was a sort of ladder, whose rungs gave the distances of objects. Shortly after Mach sug­gested using the mirror image of a wire model observed in a transparent mirror for the measurement of the dimensions of a body placed behind the glass plate.

The works of I. Harmer (1881) and F. Stolze (1884 and 1892) are of importance for the history of the development of stereo­scopic measurement. Harmer used a scale of depth consisting of a series of squares arranged one behind the other in order to measure in the stereoscope a picture of the clouds taken with a large base-line (about 15 metres). Stolze placed gratings in front of the two semi-pictures of a mirror stereoscope, one of which could be moved by a micrometer, and he thus discovered the device called the "travelling mark.” Apparently inde­pendent of all earlier experimenters T. Marie and H. Ribaut had the idea of the “ travelling mark ” in 1899 and 1900 and used it for measuring the Röntgen radiographs.

Of the applications of stereoscopy we may notice the utilization of spatial effects and troubles in stereoscopic vision (agitation and lustrous appearances) in the discovery of differences and alterations in pictures. The method was first used by Brewster to recognize irregularities in carpet patterns, and later by Dove and others for distinguishing the original from a copy, for testing coins, cheques, &c. Moreover, with the develop­ment of celestial photography, the stereoscope came to be applied to the discovery of planets, comets, variable stars, errors in plates, the proper motions and parallaxes of the fixed stars (Harmer, Kümmel, Wolf and Lenard, Förster and others).

The stereocomparator has also been employed in astrometry, and a planetoid discovered by its aid was named Stereoscopia in recognition of this application. Since 1904 binocular observation of stellar plates to determine differences in the images of the objects reproduced has been gradually discarded for the method devised by Pulfrich, which consists in the monocular observation of the two plates in the stereocomparator with the assistance of the so-called "blink ” microscope (fig. 16). In this microscope the two pictures are seen simultaneously, or individually by alternately opening the screens B1 and B2. In the second case all differences of the two images are immediately distinguished by a sudden oscillation of the image-point or by a sudden appearance and disappear­ance of single points like flash lights at sea or the modern illuminated sky lights in towns, and there is now no merit in discovering new planets, comets and variable stars by this method.

The blink microscope is far more useful than the stereomicro-scope for such purposes, for there is not one special direction in which differences can be best distinguished. It is better there­fore for the stereo method to be restricted to the work for which it is specially suitable, and for which it will never be replaced, and for such experiments as we have just discussed to be solely performed with the aid of the blink microscope. (C. P.\*)

**STERLING, ANTOINETTE** (d. 1904), Anglo-American vocalist, was born at Sterlingville, New York state. She studied with Mme Marchesi, with Mme Viardot Garcia and with Manuel Garcia, and after singing for two years in America came in 1873 to England, where she made her first appearance at Covent Garden under Sir Julius Benedict and rapidly became a popular favourite among the contraltos of the day. She gained her greatest successes as a ballad-singer, especially in such songs as “ Caller Herrin’,” “ The Three Fishers ” and “ The Lost Chord.” She was a woman of deep religious feeling and many enthusiasms, and her name was constantly associated with philanthropic enterprise. She died on the 10th of January 1904. In 1875 she had married Mr John Mackinlay, and her life was written by her son, Mr Sterling Mackinlay, in 1906.