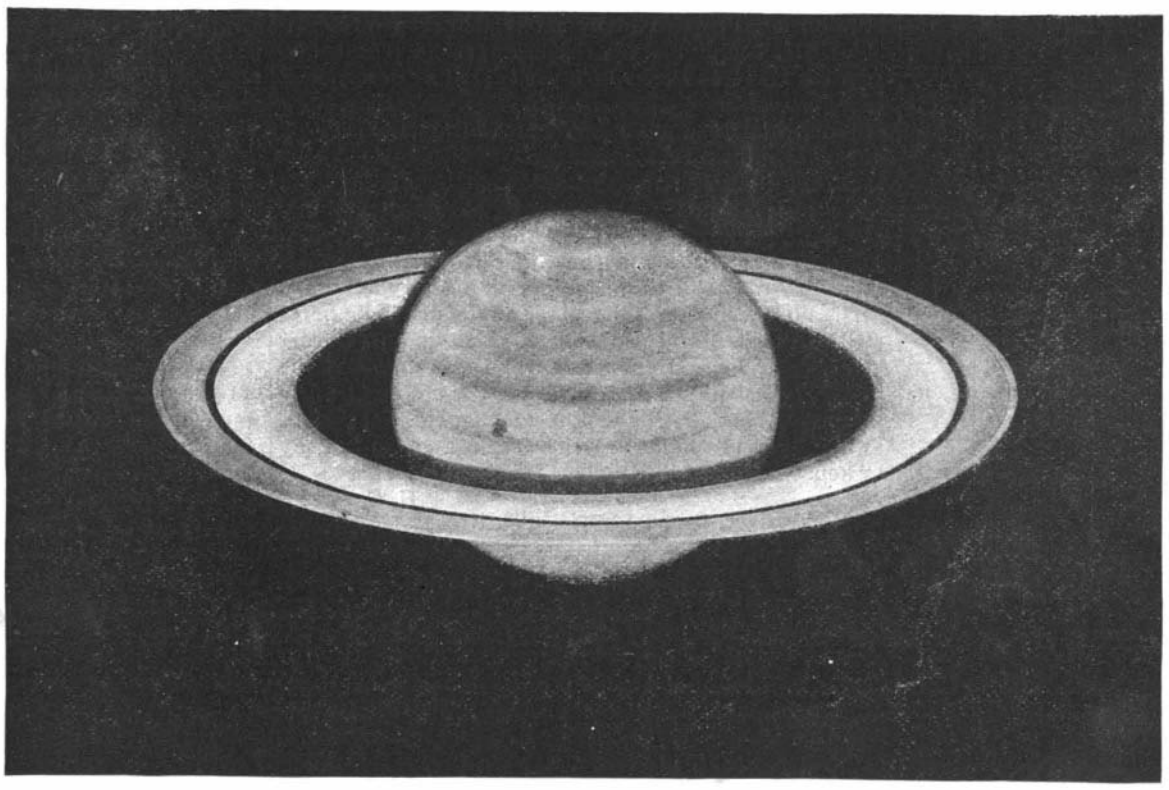
RECENT ASTRONOMICAL WORK AT THE LICK OBSERVATORY.

BY JAMES E. KEELER.

The Lick Observatory was transferred to the Regents of the University of California on June 1, 1888, and has, therefore, been in active operation as a State institution for about four months. Much of this time has been devoted by the astronomers to studying the instruments under their charge and determining the constants necessary for future work, the great telescope naturally claiming the largest share of attention; but many observations of important phenomena have been made, and the objects of greatest interest in the sky have been carefully examined with a view to the discovery of new features, as well as for the purpose of testing the performance of the lens.

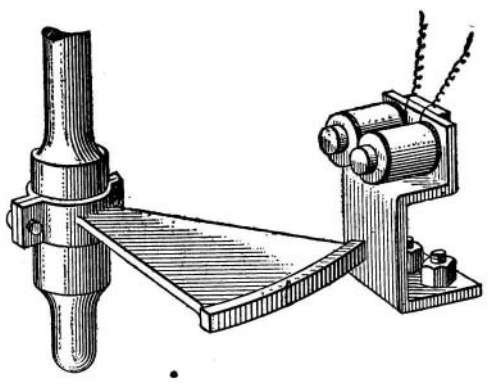


APPEARANCE OF SATURN AS OBSERVED IN JANUARY, 1888.

The sun has not yet been observed with the great telescope, but it is doubtful whether any advantage can be gained here in the study of his surface by the use of a large instrument. The seeing on Mt. Hamilton is usually poor in the daytime, owing probably to the heated air of the surrounding valleys, which is rapidly cooled at night by radiation or shut in by the fogs which then pour in from the ocean. Mercury and Venus have been seen in the daytime only, and, therefore, under the same disadvantageous circumstances. There are, however, days of good seeing, when the features of these planets can be profitably studied.

The moon is a most beautiful and interesting object with the great telescope. It was photographed throughout an entire lunation in August, and the pictures then obtained are a distinct advance on all previous work in this direction. The diameter of the lunar image on the negatives is five and a quarter inches, and with the plates used the exposure required was a little less than half a second. Observations were made with the various instruments during the total lunar eclipse of July 22, and will be published in the memoirs of the National Academy of Sciences.

Mars had become too low in the west after the transfer of the observatory to be well seen. Numerous drawings were, nevertheless, made by Prof. Holden, Mr. Schaeberle, and myself, and published in the *Astronomical Journal*. The principal canals of Schiaparelli were seen, not as double, but as single, ill-defined lines; and the continent of Libya, which, according to M. Perrotin, had been submerged or did not exist during April and May, appears on the drawings in its usual shape and position. The micrometer observations of the satellites made by myself when the planet was in opposition have been published in the *Astronomical Journal*. The satellites, which appear to have been seen with great difficulty elsewhere, were bright and easy objects with the 36 inch equatorial—a fact which affords gratifying testimony as to the superiority of the instrument and the excellence of the atmospheric conditions. Phobos was seen on July 18, when its brightness was only 0·22 of that at mean opposition and one-eighth of that at the time of discovery by Prof. Hall. From the ease with which this satellite was seen in close proximity to the planet, it seems to me probable that we can observe eclipses during favorable oppositions, and determine the mean motions of the satellites with greater accuracy than is obtainable by micrometer observations.



ELECTRIC CONTROL OF THE GREAT TELESCOPE.

Jupiter was frequently examined on fine nights in June and July. His surface showed a wealth of delicate detail which would have required a much longer time to record satisfactorily than it was possible to give. A number of observations were made of curious appearances presented by the shadows of satellites in transit. The satellites themselves appear as large and well defined disks.

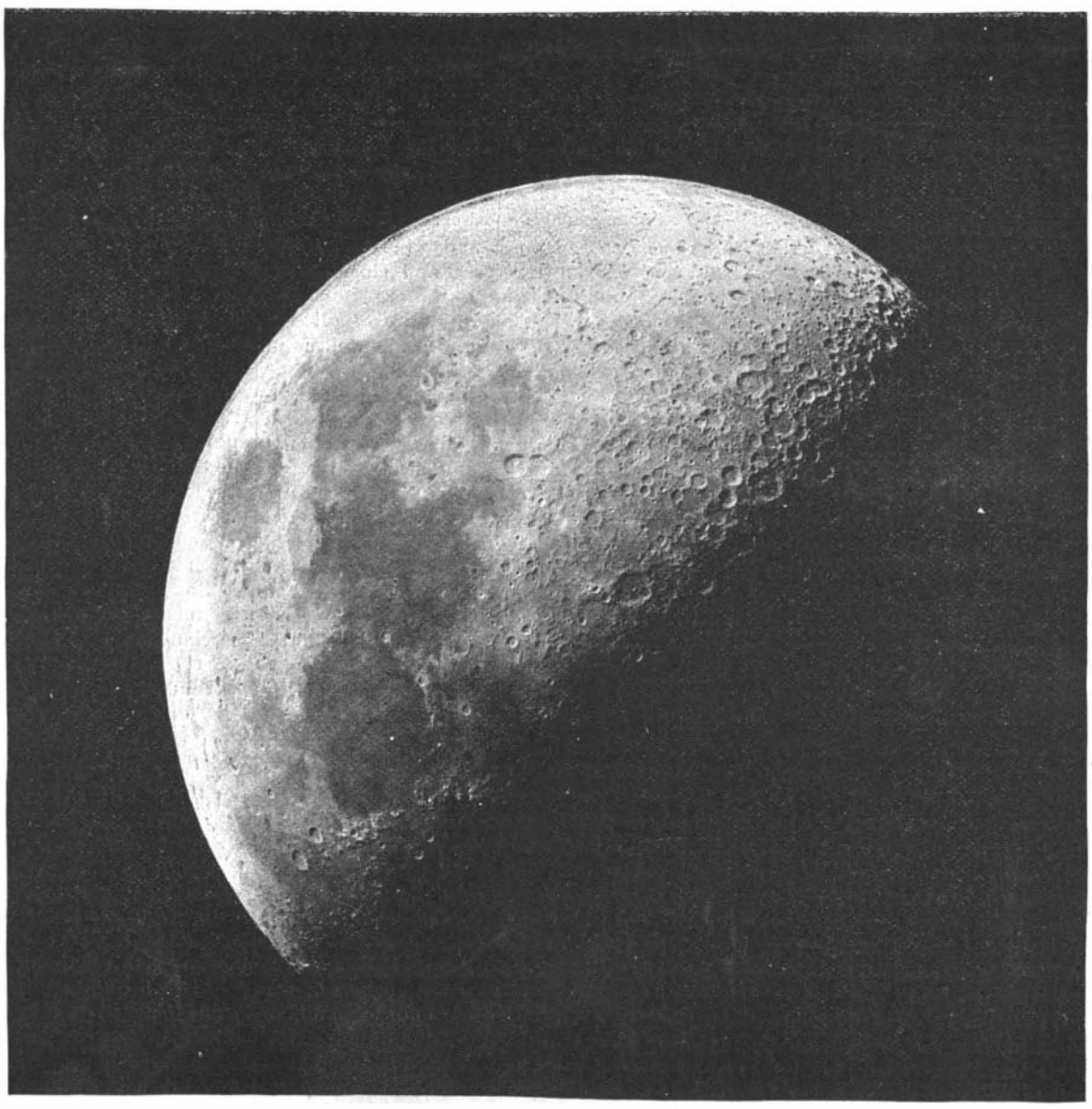
Saturn has not been observed since the telescope was first mounted in January. It was then a splendid object, all the wonderful details of the system shining with a brilliancy and distinctness probably never before equaled. The outlines of the rings were sharp and clear, and a fine dark line was seen close to the outer edge of the outer ring, with a dark shading extending inward toward the great black division. The gauze ring was very conspicuous.

Neptune has been observed by Prof. Holden and Mr. Schaeberle, and (with its satellite) has been photographed several times.

Many double stars have been discovered and measured by Mr. Burnham with the 36 inch and 12 inch equatorials. Perhaps the most interesting of this class of objects discovered with the aid of the large telescope is the star $\rho\upsilon$ (Gamma) γ Cassiopeæ, which is found to have a minute companion distant 2·2″, in position angle 256°. It has been frequently observed lately with the 12 inch equatorial. Difficult stars previously known have also been measured by Mr. Burnham.

The planetary nebulæ have been studied by Prof. Holden and Mr. Schaeberle, who have observed in several of these objects curious helical forms, which do not appear in earlier drawings with smaller instruments.

The ring nebula in Lyra is a wonderful object in the great telescope. The central star discovered by Von Hahn is very conspicuous, and four other stars of exceeding minuteness appear within the limits of the inner ellipse, while a star almost as bright as the one in the center is seen exactly at the preceding extremity of the major axis of the ring. Many other small stars not so critically situated, and therefore less interesting, are seen in proximity to the nebula. These minute stars are beyond the range of all but the most powerful telescopes, although it may be noted that there is a class of observers with very small telescopes prepared to immediately "verify" all discoveries made by powerful instruments, even when, as has sometimes been the case, the supposed discoveries are afterward found to be purely fictitious. There is no way of disproving that a difficult object can be seen by such an observer with an apparently inadequate instrument, or of showing that excess of zeal is made to take the place of sufficient optical power. Mere size, it is true, unaccompanied by other qualities, counts for but little, and the greater part of astronomical work has been done by skilled observers with instruments of moderate dimensions. To many persons the cost and difficulty of construction of great telescopes seems out of proportion to the optical advantage gained, but the same thing is seen in other departments of astronomy, as well as outside of the science. A sextant, with which the places of the stars can be determined to within a fraction of a minute of arc, costs less than a hundred dollars, while thousands must be expended if fractions of seconds are to be taken into ac-



PHOTOGRAPH OF THE MOON, TAKEN WITH THE 36 INCH REFRACTOR.

count, the error of position in either case being beyond detection with the unassisted eye.

The 12 inch telescope has been used by Mr. Barnard for the observation of comets and nebulæ. It has been found by him to be capable of giving photographic images of exquisite sharpness, and in this capacity forms an important addition to the outfit of the observatory. Twenty-five new nebulæ have been discovered by Mr. Barnard with this telescope, and a comet (comet *e* 1888) was discovered by the same observer with the 4 inch comet seeker on September 2. It is probable that the 12 inch telescope will be fitted with a new driving clock, in order to better fit it for photographic work.

No change has been made in the dome and hydraulic elevating floor of the large telescope. The convenience and, indeed, necessity of the elevating floor is every day more apparent. The rapid motion of the eye end of the telescope (a foot in eight minutes for an equatorial star) would alone make the use of an observing ladder proportioned to the size of the instrument extremely troublesome. The pier, when finally placed exactly in position, will probably be filled with brick and sand.

The driving clock of the large telescope was provided by the makers with an electric control, for keeping its rate in exact coincidence with that of a standard astronomical clock. The vertical shaft of the governor rotates in one second, and has near the bottom a small projecting pin. A stud on the end of the armature lever of an electromagnet is struck by the pin as the governor shaft rotates, when a current is passing through the magnet; but when the current is broken once a second by a standard clock, the stud is withdrawn at the proper instant to allow the pin to pass. There is also an ingenious and beautifully constructed attachment for breaking the circuit in case the standard clock should, either by accident or design, omit one or more seconds in a minute. The driving clock is adjusted to run a little fast, and is continually checked by the control, the governor being allowed to rotate by turning in a friction collar. It was found, however, that the impact of the pin on the governor shaft against the stud of the armature caused a shock which was transmitted to the telescope and produced a disturbance of the image fatal to photographic work. The control was therefore removed, and another, which I devised for the purpose of giving a perfectly smooth motion, was substituted for it. The new control answers its purpose so well, and is of such extreme simplicity, that I shall give a description of it here, as it can be applied to any clockwork having a shaft which rotates in an integral part of a second.

A soft iron sector subtending an angle of 36°, and having a radius of six inches, is clamped to the vertical axis of the governor, and rotates in a horizontal plane. The sector passes very close to the poles of an electromagnet (part of the old control) which is mounted on a slightly elastic standard of steel. At every second a strong current is sent through the coils of this magnet by means of a standard clock, the circuit being closed, as in the case of the old control, by the relay points of the chronograph attached to the driving clock. The driving clock is set so as to run a little too fast, and when the governor is started the sector gradually gains upon the click of the chronograph until it reaches the magnet of the control, when the friction produced by the attraction of the latter prevents any further acceleration, and the governor will rotate in exactly one second by the standard clock as long as the control is in operation.

The elasticity of the support on which the electromagnet is mounted plays an important part in the proper working of the control. When the sector passes at the exact instant of the passage of the current, the magnet springs in toward the sector and comes into actual contact with it, very greatly increasing the friction, while the passage of the sector at any other instant meets with no resistance, the magnet being slightly withdrawn by its support.

The current used with the control is obtained from the battery of twenty gravity cells, employed during the daytime in transmitting time signals to San Jose. As the signals are not sent at night, the battery is then connected with the control by turning a switch. With this control no shock is communicated to the telescope, and the image of a star is steady.

Since, however, changes of refraction and slight irregularities in the clockwork produce small displacements of the image in a telescope, it has always been necessary in photographing with long exposures to keep the telescope pointed by hand, correcting any displacement which may occur by the slow motions of the instrument. It was found impracticable to move the immense mass of the Lick telescope with the quickness and delicacy required in this operation, and after various experiments Mr. Schaeberle suggested that the photographic plate should be mounted upon double slides, one moving in right ascension and the other in declination, and should be kept upon a star by means of a diagonal microscope attached to the plate. A rough experimental model was constructed on this plan by the observatory machinist, and performed so satisfactorily that a plate holder of more accurate workmanship will be made on the same principle.

The public receptions on Saturday evenings interfere greatly with these experiments, as all apparatus must then be removed to fit the telescope for visual observation. Probably few visitors are aware of the hindrance to astronomical work caused by their entertainment, although, as a duty to the public, the sacrifice is always cheerfully made. Many fine nights are to be expected during the months of October and November, but after that fog and rain will almost put an end to observation until the succeeding spring.

Fig. 1.—JEAN CAUSEUR AT THE AGE OF 130.

Fig. 2.—NOEL DES QUERSONNIERES AT THE AGE OF 117.

CENTENARIANS.

Mr. Emile Levasseur has recently presented to the Academy of Sciences a very interesting communication *apropos* of the "Centenarians in France, according to the Census of 1886." The number of such persons is much less than is generally supposed. Young women have the affectation to remain young, while the old men that are cited for their great age have the vanity to grow old in order to be admired.

In Bavaria, according to the census of 1871, there were 37 centenarians; but, when the fact came to be verified, only one authentic case was found.

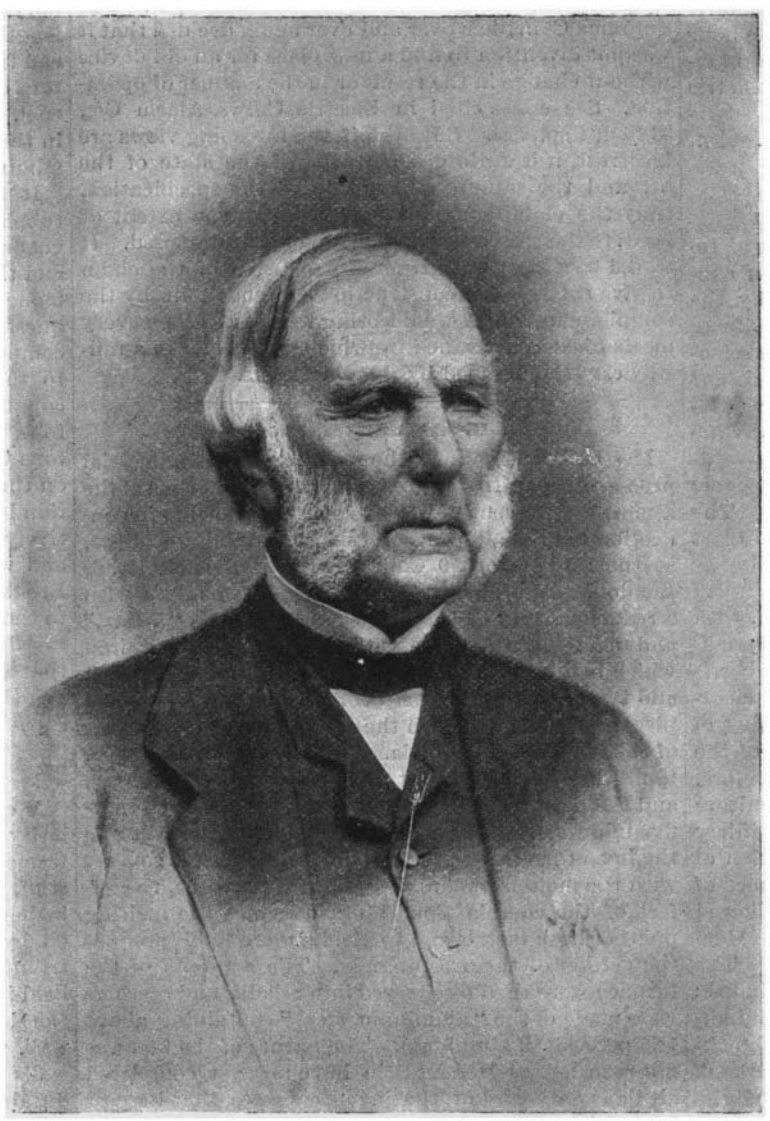
In Canada, 421 were cited. Out of this number, the social state of 82 was ascertained by the aid of *bona fide* documents, and there remained after the examination but 9 genuine centenarians—5 men and 4 women.

In France, the same delusion exists in regard to centenarians, as is proved by the reports emanating from the bureau of statistics.

After the reception of documents relative to 184 centenarians, it was found by reference to authentic records, such as registrations of baptism, half-pay lists, etc., that the number dwindled down considerably, say to about sixty. Among these there was a person named Joseph Ribas, who was born at San Estevan de Litera, in Spain, on August 20, 1770, and who lived at Tarbes.

We add to these details two little known documents on examples of extraordinary human longevity. The first of these consists of an engraving, which we reproduce in Fig. 1. It was made by Chas. Levesque, in 1772, and is very well executed. It is accompanied with the following legend: "Jean Causeur, butcher by trade, aged 130 years, born in the village of Ploumoguer, in Lower Brittany. Painted in August, 1771, by Chas. Caffieri, sculptor, by commission, to the king, for the navy, at Brest."

The second document is relative to Mr. Noel des Quersonnieres, whose portrait is published in Fig. 2, from a lithograph made in 1845. At this epoch, Mr. Des Quersonnieres was 117 years of age. He was still living the following year, as is proved by a biographical sketch published on his account. Francois Marie Joseph Noel des Quersonnieres was born on February 28, 1728, at Valenciennes, where his father was king's counselor. He became commissary-general of military supplies in 1789, and was in disgrace under the empire. He went to live at London, where he married. At the age of 117 he was still vigorous. His face is pleasant, says his biography, his hearing and sight have preserved an astonishing delicacy of perception, and his head is not entirely devoid of hair.—*La Nature.*



THE LATE COL. GEORGE H. PERKINS, OF NORWICH CONN.

A CONNECTICUT CENTENARIAN.

It is not often that one sees a hale and hearty hundred-years-old man or woman, in the full possession of the normal faculties, and filling responsible positions in life, but such an opportunity was afforded in the case of the late Col. Perkins, who died at Norwich, Conn., September 5, and whose portrait we give herewith. Col. Perkins celebrated his 100th birthday on August 5, just one month preceding the date of his death, and at that time the New York *Tribune* and other papers, in noticing his long life, bore particular testimony to the remarkable preservation of his faculties.

Col. Perkins was a native of Norwich, but as a lad was rather weakly, although he was able, in his nineteenth year, to walk to Poughkeepsie to embark on the Clermont, the pioneer Hudson River steamer, when she made her first trip to New York. During the war of 1812–14 he was paymaster for Connecticut, Rhode Island, and Massachusetts. He was present at the battle of Stonington, and was aboard Commodore Decatur's fleet when it was blockaded at New London. He was one of the incorporators of the Norwich and Worcester Railroad, the second or third road of the kind built in the United States, and from 1838 until his death was its treasurer, continuing active in the performance of his duties until three or four weeks before his death, when he left town for a vacation. He had not