ment that the marbleized ware "differs from all other enamels in that it contains no poisonous or injurious substances whatever," and that "it is unaffected by excessive heat, or acids of any description."

We have received the following from Professor S. D. Hayes, the State Assayer of Massachusetts:

To the Editor of the Scientific American:

It will be replying to many inquiries about enameled ware if you will kindly give this note a place in your columns. I have recently analyzed various specimens obtained in the open market, from dealers, kitchens, agents, and directly from the makers of these wares, and I have seen them manufactured. The wares to which I refer now are known respectively as "marbleized" and "granite" iron wares, resembling each other so much in their mottled gray color that they are not easily distinguishable by persons unfamiliar with them.

The marbleized ware, as hitherto manufactured, contains considerable lead in a soluble form, with a little arsenic, and it should not be used in cooking or drinking vessels, although there is no objection to it for other purposes. Oxide of lead adds to the elasticity and fusibility of the enamel, so that there is a temptation to use it on the part of the workmen in the factories. But serviceable enamel ware can be produced without it, and I have analyzed pieces made within a few days, by the manufacturers of the marbleized ware, that are free from deleterious ingredients.

Some of the pieces of granite ware analyzed contained a small proportion of antimony (about one per cent), which is not a dangerous element in the enamel; and as there is nothing else present that is injurious, it is safe for use in the kitchen or elsewhere. The other pieces of granite ware contained no soluble metals whatever, excepting iron, and they are entirely harmless in composition.

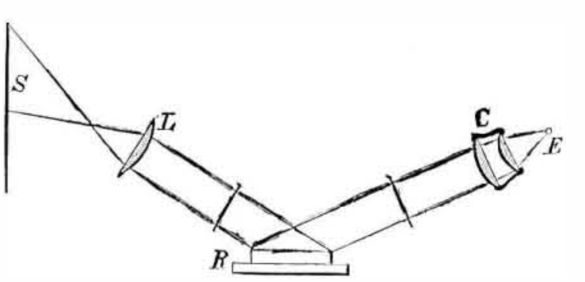
Boston, Mass. S. DANA HAYES,
State Assayer and Chemist.

PROJECTION OF INTERFERENCE COLORS FROM SOAP FILMS.

BY HENRY MORTON, PH.D.

Among all the phenomena of light, none are of such fundamental interest as those of interference; for none have a closer relation to the first principles of our theory as to the nature of light, or are so constantly coming up in all parts of the subject in connection with the most beautiful developments of color, as for example in the diffraction spectrum and in chromatic polarization. Yet until recently no means has been at command for exhibiting directly by projection this phenomenon in its characteristic beauty. Now, however, in the simple arrangement which I am about to describe, we have all that could be asked in this connection.

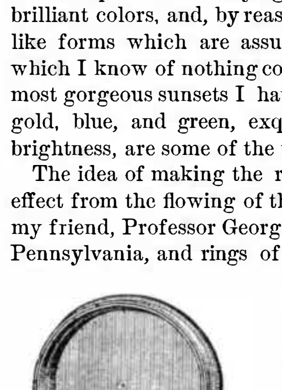
The arrangement is as follows: We place the electric light, E, in the lantern and remove the front element of the condensers so that the light comes out in a nearly parallel beam. The lantern is then turned obliquely towards the screen, and at the distance of about six inches from the condensers, C,



is set the soap film ring, R, with the soap film on its face. In such a position as to receive the light reflected from this film, is placed a plano-convex lens of about 12 inches focus, and about 4 inches diameter, which is adjusted back and forth by trial until the best effect is obtained on the screen. This effect is to begin with a gradually changing field of the most brilliant color, with occasional irregularities, but essentially passing through the tints of the spectrum to a deep violet blue.

When this point is reached, the ring, R, is to be rotated in its own plane a half revolution, so as to bring the lower part of the soap film to the top. The result of this is the flowing down over the film of various thicknesses of solution from the accumulation of its lower edge, now suddenly brought to the top. These varying thicknesses produce the most brilliant colors, and, by reason of this and the graceful cloud-like forms which are assumed, develop a spectacle with which I know of nothing comparable, unless it be one of the most gorgeous sunsets I have ever seen. Purple, crimson, gold, blue, and green, exquisitely blended and of intense brightness, are some of the tints.

The idea of making the ring rotate, so as to secure this effect from the flowing of the soap solution, originated with my friend, Professor George F. Barker, of the University of Pennsylvania, and rings of a very satisfactory character, involving several little matters of detail, are manufactured by Messrs. George Wale & Co., of Hoboken, N.J. The solution for the soap film is best made as follows: *a*. Take olive oil soap (white Castile soap), cut it into shavings with a plane, and dry thoroughly. Dissolve these shavings in alcohol until the alcohol is saturated. The solution should show a specific gravity of 0·880. *b*. Mix glycerin with water until it shows 17·1 Baume. To make the final solution: To 6·102 cubic inches of solution *b*, add 1·52 cubic inches of solution *a*, and boil until the



alcohol is all expelled. This is obtained when the boiling point rises above 212° Fah. Cool, and turn into a graduated flask, and add water until the volume is again 6·102 cubic inches. Filter, if necessary, to remove oleate of lime.

Some of this solution being poured into a small plate or shallow dish larger than the soap film ring, bring the latter, face downwards, upon its surface, until the edge is just immersed, and then, keeping the face horizontal, raise gently and turn into an upright position. Should there be drafts in the room, an ordinary glass shade may be placed over the soap film ring, without interfering with the experiment, and the film will then be more persistent and safe.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned. M. M.

Positions of Planets for June, 1877.

Mercury.

Mercury rises on June 1 at 4h. 19m. A.M., and sets at 6h. 29m. P.M. On the 30th, Mercury rises at 3h. 17m. A.M., and sets at 6 P.M.

The best time for seeing the planet is on the morning of the 20th, when it is furthest from the sun and rises an hour before it.

Venus.

On June 1, Venus rises at 4h. 57m. A.M., and sets at 7h. 57m. P.M. On the 30th, Venus rises at 5h. 41m. A.M., and sets at 8h. 35m. P.M.

Venus is small, but bright; and after the middle of the month it can be seen for nearly an hour after sunset, following almost exactly the path of the sun.

Mars.

On June 1, Mars rises a little after midnight and sets at 10h. 25m. in the morning. On June 30, Mars rises at 11 P.M., and sets at 9h. 38m. the next morning. Mars is in southern declination among the small stars of *Capricornus* and *Aquarius*, but is moving toward the north, coming into better position and increasing in apparent size.

Jupiter.

Jupiter is brilliant now in the southern sky, and will be in its best position about the middle of June. On the 1st, Jupiter rises at 8h. 50m. P.M., and sets at 5h. 51m. the next morning. On the 30th, Jupiter rises at 6h. 41m. P.M., and sets at 3h. 41m. A.M. the next day. Jupiter souths at midnight on the 20th at an altitude of 25° 10′ in this latitude.

The various changes of Jupiter's four moons can be seen with a small telescope, and many of the most interesting occur in June. On the 12th, Jupiter will be seen with only three moons until after 9 P.M., when the 1st moon will reappear from behind the planet. On the 19th, the 1st satellite will disappear between 8 P.M. and 9 P.M., by passing behind the planet; and between 10 P.M. and 11 P.M. the largest will disappear by coming in front of the planet. On June 26, Jupiter will be seen when it rises, with all four moons; but a little after 10 P.M. the first will disappear by the planet passing between us and the moon and hiding its light; this satellite will reappear in 2h. and 24m.; and for a little over an hour the four moons are still seen. But the 3d or largest is very near the planet, and a little after 2 A.M. comes in front of and is lost in the light of Jupiter. The small stars around Jupiter are those of the constellation *Sagittarius*.

Saturn.

Saturn rises on June 1 at 1h. 5m. A.M., and sets at 0h. 23m. P.M. On the 30th, Saturn rises at 11h. 10m. P.M., and sets at 10h. 29m. A.M. of the next day.

Mars and Saturn rise at nearly the same time on the 30th, but Saturn is 5° further north.

Uranus.

On the 1st, Uranus rises at 9h. 57m. A.M., and sets at 11h. 49m. P.M. On the 30th, Uranus rises at 8h. 9m. A.M., and sets at 9h. 57m. P.M. Uranus is still among the stars of *Leo*.

Sun Spots.

The report is from April 17 to May 16 inclusive. In the photograph of April 17, there appears on the western limb the group of large spots mentioned in the last report; but from this date to April 21 clouds prevented observations, and during that time the group disappeared. On April 21, a pair of small spots was seen far advanced on the eastern limb. On April 22, this pair was followed by a pair of very small ones. During the passage across the disk, there was a continual change in the number and arrangement of the spots in these two groups. Before April 30, both had disappeared. In the picture of this date, a small group was seen on the eastern limb; but after May 5 it could not be found. When last seen, it was near the center of its course, but very faint. The observation of May 5 showed a small spot, followed by a very faint one. On May 4, these spots had not been seen, and were first visible on the western limb. On May 8, a large spot was seen coming on. From May 8 to May 12, no observation could be made. On May 12, two large spots were seen near the center; one of these was seen before May 8, the other had burst out between May 8 and May 12. The one first seen on May 8 disappeared between May 13 and May 14 at about the center of its course; the other is still visible (May 16), and is at present preceded by a small spot not seen on May 15.

GRANT'S IMPROVED HORSE HAY FORK.

We illustrate herewith a new and ingenious apparatus for unloading hay and like material by means of horse power. The advantages claimed are simplicity and strength, and the adaptability of the device to unloading barley or any like substance, either long or short, ordinarily difficult to handle by appliances of this kind. Fig. 1 is an exterior view, and

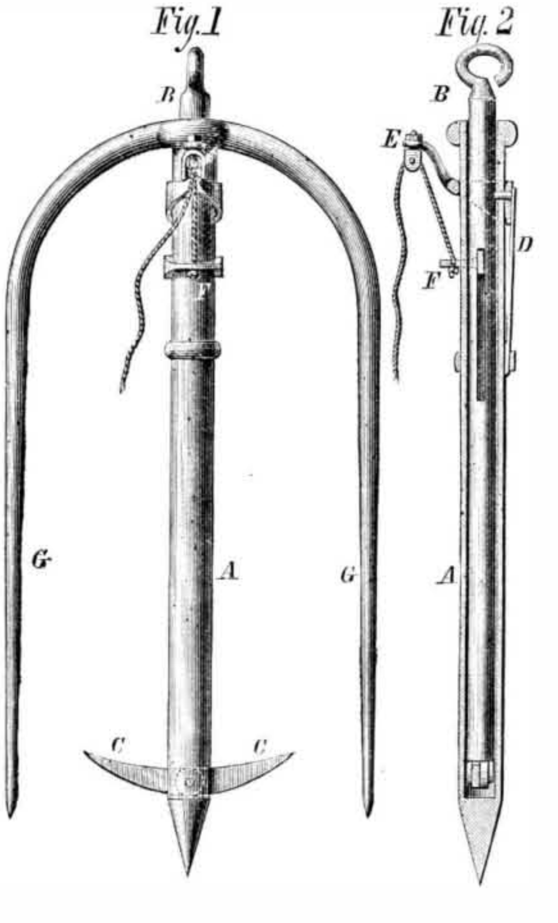


Fig. 2 exhibits a section of the central tubular tine, A. Into this tine fits a tubular plunger, B, which is provided at its upper end with a hook, and is plugged at its lower extremity, where are affixed ears to which the barbs, C, are pivoted. The spring, D, is clamped to the tine by a band and screw, and has a catch pin which passes through the disengaging lever, E, and the side of the tine, and enters a hole in the plunger, B. The lever, E, encircles the tine, and rests under the spring, and is held in place by the catch pin. The end of this lever is bent upward, and is provided with a small pulley. At F, is a key, which passes through a mortise in the tine and through a slot in the plunger, thus serving to limit the motion of the latter. The end of the key is bent over the front of the tine, and is formed into an eye, to which the disengaging cord, which passes upward over the pulley, is attached. At G are lateral tines, which are detachably secured to the central tine, so that, when a light fork is desired, the latter may be used alone.

In using the apparatus, the plunger, B, is drawn upward until caught by the catch pin. In this position, the barbs, C, are retracted. The fork is then lowered into the hay or grain until well buried. The lever cord is then pulled, when the catch pin is withdrawn from the plunger and the latter descends, throwing out the barbs. These as they extend press and pack the material up into the crotchets of the tines. In this position, the plunger is again caught by the catch pin; and as the bottom of said plunger rests on the barbs, the weight thereon is taken off their pivots and brought to bear on the key, F. The load is then lifted. When it is to be discharged, the lever is again moved, the catch pin withdrawn, and the weight causes the fork to descend, the plunger remaining stationary. This causes the retraction of the barbs and consequent release of the hay. The invention received an award and commendatory report at the Centennial Exposition.

Patented through the Scientific American Patent Agency, April 3, 1877. For further information relative to sale of territory, etc., address Peter Grant, Clinton, Ontario, Canada.

A Large Passenger Steamer.

The new steamboat, the Massachusetts, of the New York and Providence line, was built by Mr. Steers, of Greenpoint, N. Y. Her dimensions are as follows: Length, 325 feet; beam, 46 feet; beam, over all, 76 feet; depth of hold, 16 feet 4 inches. The frames are of white oak and locust and cedar, the floor timbers of white oak, and the top timbers of locust and cedar. The deck is of white pine. The launching weight of the Massachusetts, without the machinery or joiner work, was 1,000 tons. The engine is of the vertical beam type, with all the recent improvements. There is a 90-inch cylinder with a stroke of 14 feet. The wheels measure 39 feet 7 inches in diameter. There are two smoke pipes. The boat will be steered by steam. The interior arrangements are very handsome.

THE dreaded *hemileia vastatrix*, which has hitherto been confined to coffee plantations of Ceylon and Southern India, has at last made its appearance in Sumatra, and in all probability will find its way before long to the neighboring islands where coffee is grown.