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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 512,

For the Week Ending October 24, 1885.

Price 10 cents. For sale by all newsdealers.

EFFECTS OF THE FLOOD ROCK EXPLOSION.

There is every reason to believe that the calculations of the engineers, in all their work on Flood Rock, were fully borne out, and their anticipations in every way met, by the results of the explosion of October 10. Over the whole of the area which had been mined, covering about nine acres, only a small proportion of which was above even low tide, the throwing up of water by the explosion showed that the dynamite everywhere had done its work, while the plans had been so judiciously made that the entire energy of the vast quantity of explosives employed was developed in the breaking and shattering of the rock. Many had looked for a much greater show of flying rocks and timbers, but this the engineers had guarded against by using much less dynamite around their entrance shaft, and under the rock exposed above water, than was placed in the parts where the water could act as a sufficient cushion. The official survey has not yet been completed, but sufficient has been determined, from the soundings and the inspection of divers, to show that the rock has been pretty thoroughly broken up. The rock has been sinking daily since the explosion, and on the north and south sides is so shattered that it can be dredged without difficulty. On the east and west sides the surface fragments are larger, and will probably require blasting, but the whole reef seems to be full of fissures, generally following the trend of the rock.

A NEW DYNAMITE GUN.

Many attempts have been made to substitute dynamite for the ordinary projectile thrown from the heavy gun. Its terribly destructive powers and the comparative safety with which it may now be handled make it peculiarly adaptable to offensive operations. It cannot be said that the experiments thus far made have been particularly gratifying; indeed, the contact of dynamite with an object representing the armored side of a ship, made in some experiments a year ago, was disappointing in its effect, doing nothing like the damage that had been promised and expected. Yet the experiments were but crude; and the fact that dynamite can safely be thrown from the mouth of a heavy gun by means of compressed air is of importance in itself, and hopes are entertained that a means will yet be found of utilizing the principle to advantage.

A very interesting experiment looking to the development of this principle was made last week at Fort Lafayette in New York Harbor, with a dynamite gun sixty feet long and an eight inch bore, poised on the redan of the fort, and resembling a great telescope. The object of the constructors of this gun is to throw dynamite against the sides or upon the decks or in the water and close to a hostile ship. They claim that they can do this with precision and dispatch within a radius of about two miles. It cannot be said that they demonstrated this in the experiments of last week, and yet these experiments were attended with enough success to impress the careful observer with the practicability of the project.

To show the power of the gun, a projectile weighing 200 pounds was thrown about a mile and a half, the air gauge showing one thousand pounds pressure, and the elevation of the piece being 30°. Then a projectile somewhat resembling a fish torpedo, having a core of five pounds of No. 1 dynamite surrounded with a quantity of explosive gelatine, was thrown to a distance of something over a mile, but failed to explode. There is reason to believe that this failure was owing more to the ordinary mishap attending public exhibitions of crude apparatus than to any defect in the principle.

Aware of the uncertainties of firing at a movable mark, the constructors of this dynamite gun have anticipated the failure of a shot to take effect by striking the water instead of the ship; and besides the percussion in the contact point of the projectile, there are two small dry batteries in its wooden tailpiece, which, when reached by the sea water, are expected to act upon a fulminate cap, and the detonation explodes the dynamite. The charge of a hundred pounds of dynamite that this gun is intended throw will, they say, if exploded in the water within several hundred feet of the modern iron war ship, kill those on board by shock. This is surely an extraordinary assertion, and there is reason to believe that they would find it impossible to sustain it.

But the experiments of last week show that dynamite can safely be thrown a short distance by compressed air, and this knowledge may be used with effect in advancing the science of harbor defense.

The air for firing is stored in six large reservoirs having walls capable of sustaining a pressure of 2,500 pounds to the square inch. The firing pressure of 1,000 pounds comes into the chamber behind the missile so slowly, and with an increasing pressure so gradual, that all danger of premature discharge of the dynamite by shock would seem to be avoided.

The expressed belief of the projectors that this gun will prove most effective placed *en barbette* in land works or in barbette towers aboard war ships seems to have little to sustain it, because its range—two miles—is so limited that it could not be worked while the marine guns carried by modern war ships were in play. At the distance of three, four, or five miles—a point-blank range for the great guns of to-day—a modern war ship could lie at ease out of its range, and tear it to pieces. If "it should be protected by heavy guns of modern construction," as suggested by one of its constructors, there would be scarcely any need of it at all, for it could take no part in a pounding match at what would be short range for modern guns.

But if it will fulfill the promises made for it, it would be invaluable in harbor defense when placed aboard of a quick moving torpedo boat. In order to make the ordinary torpedo effective, the torpedo boat must run up and take a position close aboard the enemy before discharging the projectile—always a dangerous and uncertain operation. But if this telescopic gun will throw its charge of one hundred pounds of dynamite only a mile with precision from the deck of a torpedo boat, it would possess advantages over the ordinary method which are readily apparent, and the most powerful war ship afloat, if beset by three such torpedo boats, each similarly armed, might belch forth her tons of iron and steel, and set all her pepper-boxes to work in vain.

It has not yet been proved, however, that the dynamite gun can do what is promised for it.

BENDING CAST IRON.

The quality of cast iron in softness—yielding to tool working—and in toughness has been greatly improved within the memory of many workers who are not old men. The crisp, brittle, hard character of cast iron has been changed to a material of a purer condition and therefore better nature.

One of the peculiarities of modern cast iron for machinery purposes is its flexibility, its capacity of being moved from its moulded position and retaining its new contour. In the older time it was necessary to peen a casting in order to permanently bend it; and this peening was rarely more than skin deep. The action of peening is simply to expand the surface of the casting by the quick, sharp blows of the peen end of the machinist's hammer—the unattached parts must, perforce, give to this persuasion. The consequence is that the hammered side is stretched, just as hammering will stretch lead, or silver, or copper, or any malleable metal. But the objection to the peening process is that the after-working by the file or the planing tool may destroy all the work done by the peen end of the hammer.

But it is possible to permanently bend cast iron without resort to such heroic methods as peening, and the ruder one of heating to redness in a forge fire, bending while soft, and plunging into cold water; the last so risky of breaking the casting that it is seldom tried except on cheap stuff like grate bars or similar traps. Good cast iron can be bent and keep its bend without the slow process of peening or the risky one of bending under intense heat and chilling in cold water with the chance of breaking. And this quality is sometimes handy.

In a cotton mill for spinning peculiar yarn, the leaders on a spooler require to have a decided curvature near their heads. For convenience in finishing and fitting, and for economy in production, castings were preferable to forgings. These castings were made flat; but after being finished they were heated over a blaze, and bent under a lever. The amount of bend was more than 30°.

A casting was made recently which required two turns or bends in its length, the casting weighing something over three hundred pounds. The superintendent determined to make the casting straight, plane and finish it, and afterward bend it to shape. This was successfully accomplished. The curved pattern would have been costly, the resultant casting might have been faulty, and the hand dressing and finishing of the double curved casting would have made the piece cost more than if forged. But a forged piece, of wrought iron, was just what was not wanted; it was a casting, and it was made.

Where the bends were to be made were stationed alcohol lamps, the piece being suspended between proper supports. After the under side being heated to a degree that would have drawn hardened steel to a straw color—as a supposable degree of heat—a pressure, by weighted lever, was introduced on the upper side of the casting. As the lamp was moved from point to point, it was surprising to see how the iron yielded to the pressure and the heat. A curve was made that could not have been finished by planing, and yet the bent casting retained its finish, only the discoloring by the lamps being necessary to be removed by emery cloth rubbing.

A crooked casting, withdrawn out of line by injudicious pattern making and lack of sensible moulding in the foundry, was about to be thrown on to the scrap heap at a loss of nearly a hundred dollars. It was straightened to usefulness simply by the careful use of two gas flames diffused by wire netting, and by the use of weight. It is quite possible to bend or to straighten cast iron to an appreciable extent by a quite low degree of heat, if the heat is judiciously applied; a gradual heating of the side to be elongated by a heat that can be controlled, and the simultaneous persuasion of weight, lever, or screw, will do wonders on such a material as the cast iron that is usually considered to be of too friable, untenacious, and brittle a nature to be much beyond stone in resistance to tension; but even stone will bend.

Purifying Air by Washing.

M. Windhausen has designed an apparatus for the purifying of air from dust, germs, and other impurities which is well spoken of by French technical writers. The principle of the appliance is to impart a rotatory movement to the air to be purified; the air being at the same time surrounded by a surface of water in movement. The idea is that in this way the solid impurities which may happen to be in the air will be thrown, by centrifugal force, against the water surface; and they will consequently be taken up and carried away by it. The actual apparatus consists of two horizontal concentric cylinders placed in connection with a fan. The fan and cylinders are fixed upon and turn with the same spindle, and the whole is inclosed in a casing. The cylinders are closed at the ends, except for a hole permitting the passage of air drawn by the fan. As the air passes through the concentric space between the drums, it is caused to rotate with them by the presence of feathers running longitudinally on the inside of the outer cylinder.

The spindle which carries the whole arrangement is hollow; and it thus serves to bring the water, which is allowed to escape therefrom inside the drum by means of fine holes, which project it in the form of fine rain against the inside of the inner cylinder. This cylinder is also perforated, and the water again escapes from it and is projected against the inside of the outer cylinder, over which it spreads as a thin coating. The motions of the air and water are as nearly as possible in opposite directions. The water after it has been sufficiently exposed to the air is allowed to escape, and is drawn off by means of a siphon. It is impossible for any air to pass through the apparatus without being washed, and its solid impurities removed by centrifugal action; and the proportion of water required may be varied as found necessary with reference to the condition of the air. The apparatus may be combined with any device for warming or cooling the air; or the same arrangement may be modified for treating smoke or gases.

MICROSCOPICAL EXAMINATION OF THE PHENOMENON OF COLORS OF THIN PLATES

BY GEO. M. HOPKINS.

As all works on light and on general physics treat on the phenomenon of the interference of light as exhibited in thin transparent plates or films, it will be unnecessary to go into an examination of this subject in detail; but it will doubtless prove both interesting and profitable to those interested in microscopy to take up the study of this subject with the aid of the microscope.

There is nothing more beautiful than Newton's rings, or a soap film, or extremely thin plates of mica when viewed in a microscope by properly directed light. Even the gorgeous colors of polarized light cannot be excluded in this comparison; but it is difficult with ordinary appliances to see these exquisite tints.

The writer, after some experiment, devised mounts for the ready exhibition of Newton's rings and interference phenomena, as shown by the soap film.

The device for the exhibition of Newton's rings is shown in Figs. 1, 2, and 3; Fig. 1 showing the position of the mount on the microscope stage; Fig. 2 being a perspective view of the slide; and Fig. 3 a diametrical section of the rubber cell, containing the plane and convex glasses. The plane glass is a disk cut from one of the finer kinds of glass slips, commonly used in mounting objects. The convex disk is cut from an ordinary 24 inch biconvex spectacle lens. The cell is screw-threaded internally, and provided with a screw-threaded ring, which clamps the two glasses together. The cell so formed has, in diametrically opposite sides, cavities for receiving the ends of the wire frame, and the wire frame is clamped to the face of the slide by a clip and two screws. The cell containing the glasses is in this way supported so that it can be raised or lowered, or tilted at any required angle.

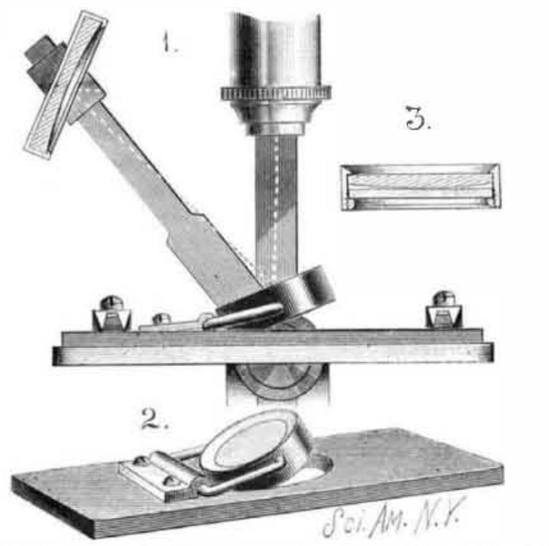
The position of the cell relative to the source of light is shown in Fig. 1. The cell and the source of light or the mirror should be arranged so that the image of the flame used for illumination or the broad light of the sky will be reflected up the tube. The objective (a 2 inch, with an A eyepiece) may now be focused, when the rings, which about fill the field, will appear with great brilliancy. The effect may be somewhat varied by turning the cell at different angles, and moving the source of light accordingly. The concave mirror is used to concentrate the light; but, of course, a condenser may be used instead, or, if the light is strong enough, the beam may be received directly on the glass of the cell, and thrown up the tube.

With the unaided eye the rings appear as a very small disk, with no very noticeable beauty; but in the microscope it is not only greatly magnified, but properly illuminated.

An interesting experiment, showing the difference between the effect of pure sunlight and artificial light, consists in adjusting the mirror so as to simultaneously receive light from the sky and from a lamp or gas light. The portion of the disk illuminated by the lamp light shows the predominance of yellow, a greenish hue taking the place of the blue; the red being also modified.

Monochromatic light, such as is secured by passing light through a deep red glass, for example, shows the rings as alternately red and black.

The device for exhibiting the soap film, which is



MOUNT OF NEWTON'S RINGS FOR THE MICROSCOPE.

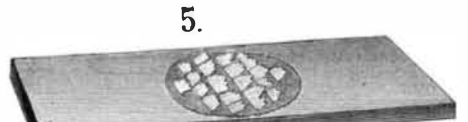
shown in Fig. 4, will now need little explanation. A ring is pivoted in the same manner as the cell already described. By dipping the finger in soapy water, and passing it over the ring, a film will remain in the ring, which may be viewed in the same manner as Newton's rings. The bands of iridescent color are very brilliant, and the eddies and swirls of gorgeous colors are something beyond description.

Thin plates of mica exhibit the same phenomenon. By tearing a very thin plate of mica, so as to leave a ragged edge, many extremely thin points will remain projecting from the torn edges; these may be cut off, and cemented in a suitable position for observation. These little points are quite difficult to handle. Probably the easiest way to manage them is to cut the piece of mica down quite small, and then take the bright point in a pair of clean forceps, and cut the

4.

HOLDER FOR SOAP FILM.

5.



MOUNT OF MICA PLATES.

larger part off, then touch the edge of the bright piece to Canada balsam, and put it in position on the slide. These little plates of mica are viewed in the same manner as the Newton's rings.

It is perhaps hardly necessary to say that having prepared a good mount of the mica plates, it is advisable to inclose it under a cover, as soon as convenient, to exclude dust.

Removing Microbes from Water.

Professor Frankland has recently made a series of experiments on the relative efficiency of filtration, agitation with solid particles, and precipitation as a means of removing micro-organisms from water. His method was to determine the number of organisms present in a given volume of the water, before and after filtration. The filtering materials were greensand, silver sand, powdered glass, brick dust, coke, animal charcoal, and spongy iron. These materials were all used in the same state of division, being made to pass through a sieve of forty meshes to the inch. Columns 6 inches in height were used. It was found that only greensand, coke, animal charcoal, and spongy iron wholly removed the micro-organisms from the water filtered through them, and that this power was lost in every case after the filters had been in operation a month. With the exception of the animal charcoal, however, all these substances, even after being in operation for a month, continued to remove a very considerable proportion of the organisms present in the unfiltered water; and in this respect coke and spongy iron occupied the first place. Water containing micro-organisms was also agitated with various substances in the same state of division as above mentioned, and after subsidence of the suspended particles, the number of organisms remaining was determined. A gramme of substance was in general agitated with 50 c. c. of water for a period of about fifteen minutes. It was found that a great reduction in the number of organisms could be produced in this way; and the complete removal of all organisms by agitation with coke is especially to be remarked. Precipitation by "Clark's process" also showed that it affords a means of greatly reducing the number of these organisms in water. Dr. Frankland concludes from his experiments that, although the production in large quantities of sterilized potable water is a matter of great difficulty, involving the continual renewal of filtering materials, there are numerous and simple methods of treatment which secure a large reduction in the number of organisms present in water.—*Journal of the Society of Arts.*

Trying a Dynamite Gun.

The pneumatic dynamite gun, tested last week at Fort Lafayette, is the development on a large scale of the system of throwing high explosives from guns by means of compressed air. Experiments with this system have been in progress for several years past with small guns with from two to four inch bore, throwing from 10 to 20 pounds of explosive gelatine about a mile, using a pressure of 500 pounds to the square inch.

The system, in brief, consists in the use of a reservoir for compressed air connected to a gun-barrel by a suitable firing valve, this reservoir having a cubic capacity six times greater than the bore of the gun, measured from breech to muzzle. A shot loaded with explosive gelatine is placed in position through a breech-closing mechanism, when, by means of a firing lever, the valve is made to deliver a quantity of air from the reservoir into the barrel just sufficient to fill it, and shut off the supply just at the point when the shot passes out of the muzzle, thus subjecting the shot during its passage through the barrel to a pressure equal to an average of the initial and terminal pressures in the reservoir. A space is left between the base of the shot and the face of the firing valve, which acts as an air cushion, starting the shot without shock or jar, thus avoiding explosion. Each shot is fitted with fulminate primers, which explode the charge on impact.

In the small guns referred to above, full air pressure was never obtained on the base of the projectiles, on account of faulty valve action, and numerous minor points of construction were impracticable; but the absolute surety with which high explosives could be handled, proved by a large number of shots said to have been made under all sorts of conditions, favorable and unfavorable, if the private tests have not been exaggerated in their description, did much to prove the correctness of the principle involved.

The dynamite gun is large enough to carry 100 pounds of explosive gelatine two miles, and its projectors expect it to supersede all kinds of self-propelling torpedoes, except in special cases. It will, they think, if successful, introduce into warfare an aerial and explosive shell.

This gun was constructed from plans furnished by Mr. Nat. W. Pratt, a practical and ingenious mechanician. It has a bore of 7¾ inches with a barrel 60 feet long, hung on trunnions at the breech and in a pair of heavy cast supports, which in turn are bolted to a carriage running on a track for side training. The elevation is obtained by swinging the gun on its trunnions. Both motions are performed by the compressed air in the reservoirs, which rest on the carriage and turn with it.

The handling of the gun is controlled by the man who does the firing. The gun's crew consists of the gunner and two men to load. The valve which regulates the flow of the air into the barrel is eight inches in diameter, and works under a total load of over 75,000 lb. without shock or jar, and the amount of air to be discharged at any one shot can be regulated at will; the valve always giving a full opening, delivering the full pressure on the base of the shot, but remaining open a longer or a shorter time, according to the amount to be delivered.

Unlike the smaller guns, there are no movable joints under pressure, and it is said no leaks are found when working under a full pressure of 1,000 lb. per square inch. On account of the greater pressure at which this gun is worked, and the certainty that full pressure is delivered on the base of the shot, the experiments of firing dynamite have been very carefully conducted.

At the exhibition last week a projectile weighing 200 lb., one hundred pounds of which was explosive gelatine, was fired with 1,000 lb. pressure at an elevation of barrel of 30°. At this writing the exact range has not been received from those operating the plane-tables at Fort Hamilton, but it was thought to be about a mile and a half.

Unfortunately, the electric battery which should explode the charge upon contact with the water did not do its work.