TORPEDO BOAT ARMED WITH PNEUMATIC DYNAMITE GUNS.

In former issues of the SCIENTIFIC AMERICAN we have given illustrations and detailed descriptions of the pneumatic dynamite gun invented by Lieutenant E. L. Zalinski, of the U. S. Artillery Corps. This gun, it will be remembered, was designed to throw a projectile loaded with dynamite or nitro-glycerine by means of compressed air; and so successful were the experiments carried on with it at Fort Lafayette, under the supervision of a board of naval experts, that Congress eventually appropriated $350,000 for building a swift torpedo boat, large enough to go to sea, and to be armed with three of these guns. Contracts for this boat have been signed with the Cramps.

The upper view in the accompanying engraving is a longitudinal vertical section, the lower one being a plan view. The following details regarding the boat we take from the *Sun*. The boat will be 250 ft. long, 26 ft. beam, and will draw 8 ft. of water. Her displacement will be about 800 tons. The engines will be of the triple expansion type, of the best known design, and the guaranteed power will be 3,200. She will be propelled by twin screws, and it is expected that the guaranteed speed of 20 knots an hour will be exceeded.

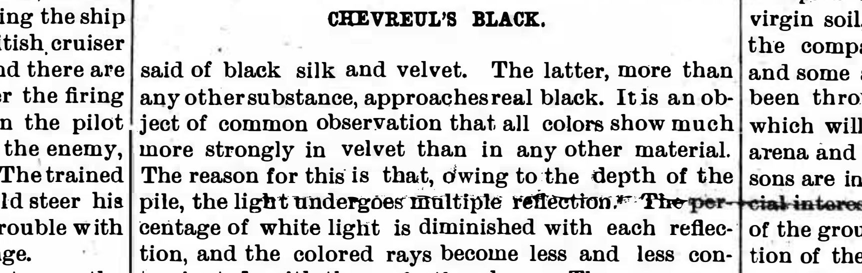
The three dynamite guns are to be placed side by side, at the elevation indicated in the upper view. They are to be fired in their places, but their range can be varied by increasing or diminishing the charge of air let in behind the projectile. An extreme range of one mile is put down in the contract, and the weight of gelatine to be thrown is 200 pounds; but the guns, as now building, will throw 400 pounds instead of 200 pounds, and the effective range will probably be about two miles. Air chambers and compressors of sufficient size and power are provided to enable fifteen shots to be fired to the distance of one mile without stopping; but if the boat were heading for the enemy at full speed, thirty shells could be thrown before the air would be exhausted and the cruiser obliged to turn tail. Thirty shells would mean the explosion of 12,000 pounds of nitro-glycerine about the enemy.

In fixing the gun permanently in its place, the designer has followed out the old idea of making the ship simply a floating gun carriage. The new British cruiser Polyphemus is built on the same idea, and there are other floating gun carriages. In this cruiser the firing is entirely under the control of the officer in the pilot house. He has simply to head his boat for the enemy, dash ahead at full speed, and blaze away. The trained pilot, even in the excitement of battle, would steer his ship instinctively, so there would be little trouble with the aim, except, perhaps, in getting the range.

Each gun can be fired once in two minutes, or the three successively in two minutes.

The new cruiser has a freeboard of about four feet above water. This is quite enough to enable her to travel anywhere along the coast. She carries enough coal to travel 5,000 miles at 12 knots an hour. This would take her about 700 miles at full speed. She could probably turn a complete circle of a radius of twice her length in between two and three minutes. She can carry 100 or even a much greater number of torpedoes with her when going on a cruise. To show how she compares with the best of the latest English built torpedo boats, it may be said that the Destructor, built for the Spanish Government, carries but ten torpedoes, although she has five tubes to fire them from, and this is the usual number carried. The range of the best of these foreign torpedoes is 600 yards, under the most favorable circumstances, and in a seaway not more than 100 or 200 yards. The exploding charge is 75 pounds of gun-cotton, an explosive that is exceedingly inefficient when compared with nitro-glycerine.

The new boat will also be armed with the usual rapid-firing guns which are placed on foreign torpedo boats. These are to be used in battle with craft like herself and small boats. It is expected that she will be finished in six months.



TORPEDO BOAT ARMED WITH PNEUMATIC DYNAMITE GUNS.

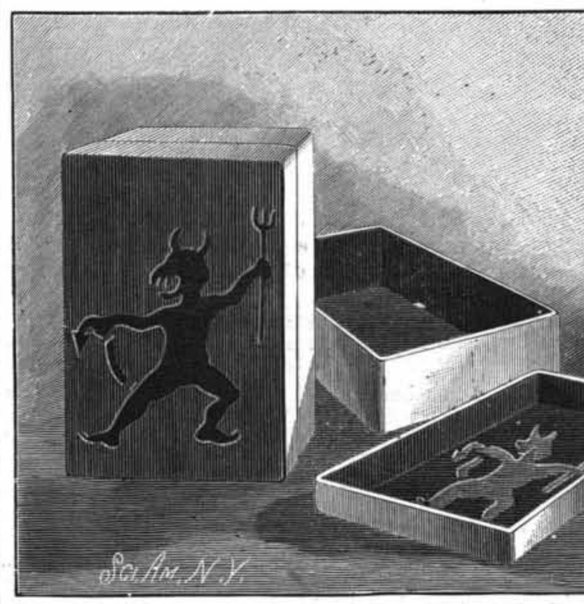
The Strength of Snails.

Perceiving a common snail, *Helix aspersa*, crawling up the window blind one evening, it occurred to me to try what it could draw up perpendicularly. Accordingly, I attached to its shell four reels of cotton, fastening one after the other until I ascertained that a greater load would exceed the limit of its strength. I then weighed the entire load, and found that it weighed 2¼ ounces, while the snail weighed only ¼ ounce. Thus it was able to lift perpendicularly nine times its weight. I then made an experiment with a larger snail, weighing one-third ounce, the load being composed chiefly of the same material as the last, but so placed as to be drawn in a horizontal position on the table. Reels of cotton to the number of twelve were fastened to it, with a pair of scissors, a screw driver, a key, and a knife, weighing altogether seventeen ounces, or fifty times the weight of the snail. The same snail when placed on the ceiling was able to travel with a weight of four ounces suspended from its shell. I next tried it on a piece of common thread, suspended and hanging loose with another snail of its own weight, which it carried up the thread with apparent ease. After this I tried it on a single horsehair strained in a horizontal position, but it had then enough to do to crawl over this narrow bridge without a load.—*E. Sandford, in Zoologist.*

CHEVREUL'S BLACK.

T. O'CONOR SLOANE, PH.D.

The production of absolute black by a pigment or surface coloration has been shown by Chevreul to be an impossibility. No substance is known that does not possess the power of reflecting light to some extent. If paper is blackened, its surface will reflect rays that can act powerfully upon the sensitive plate in a camera, even if the eye, by convention and association, would determine it to be actually black. The same is to be



CHEVREUL'S BLACK.

said of black silk and velvet. The latter, more than any other substance, approaches real black. It is an object of common observation that all colors show much more strongly in velvet than in any other material. The reason for this is that, owing to the depth of the pile, the light undergoes multiple reflection.* The percentage of white light is diminished with each reflection, and the colored rays become less and less contaminated with those of other hues. The same reasoning applies to black velvet. The light by multiple reflection from its substance is more and more absorbed, and the familiar intense black is the result. A piece of this material, placed upon cloth or silk, always appears, and is, the blacker. In choosing velvet for such experiments, care must be taken not to use a blue black. The dead black is the proper one to select.

Black being the absence of color is producible by excluding light. The production of the velvet black, we have seen, depends on the mechanical texture of the goods. Nothing is so black as a perfectly dark room. Carrying out these principles, Chevreul devised the wonderfully ingenious way of producing a true black which we illustrate.

He lined the interior of a box with black. Pigment, black silk, or black velvet may be used. In the cover of the box he made a hole, not too large, but bearing a certain ratio to the area of the cover. The size should not exceed one-tenth this surface. The spot thus produced reflected no light, as there was no surface. The interior of the box, by color and shadow, was prevented from reflecting any light, so that absolute blackness resulted. The blackest velvet or silk placed alongside of this spot appears lighter in color.

In constructing the apparatus illustrated, a famous proverb was selected as a theme, in which a certain personage is stated not to be so black as he is painted. The author of "English as She is Spoke" renders this proverb, "He not so devil as he is black." The blackness of this image is absolute.

A pasteboard box is lined with black silk or velvet, and any desired figure is cut through the cover. This may then be painted as black as possible, or before the figure is cut out, silk or velvet may be pasted over it, and the figure cut through pasteboard and covering together.

Then, on putting the cover in place, holding the box so that a side light will fall upon it, thus preventing direct access of light rays to the interior, the figure will stand out strongly black against a background which, but for the contrast, would itself be pronounced absolutely black.

To apply the most rigorous test, a member of the Society of Amateur Photographers of New York made a photograph of such a box. A carbon B dry plate was used, with thirty-five minutes' exposure, with stop *f*-30. The result was a negative perfectly transparent where the figure came, but strongly affected by the black box cover. Part of the cover was coated with black silk and part was painted, but both reflected light enough to produce a full photograph upon the plate.

A most interesting application of this principle on the large scale has been made of late years, especially by E. J. Marey, in the photography of moving animals.* With Chevreul's black as a screen, a plate can be exposed unaffected by the background, and will reproduce objects moving across the space with perfect fidelity.

The American Exhibition, London.

Recently we had an opportunity of going over the grounds of the forthcoming American Exhibition at Earls Court. The site is comprised in the triangle between Earls Court, West Brompton, and West Kensington stations, and is thus extremely well situated for easy access from all parts of London. The area that will be covered by the exhibition is about twenty-three acres, eight of which are on one and fifteen on the other side of the West London line, an iron bridge over the railway connecting the two portions. Although the work has been going on for some time, little is as yet seen of any building, the operations up to the present having been confined mostly to earth works, leveling, and draining. The land to be occupied by the exhibition might almost be called virgin soil, and all the drains had to be put in by the company. A good deal of soil has been moved, and some artificial mounds of considerable extent have been thrown up. In that portion of the exhibition which will be illustrative of the "Wild West," a large arena and a grand stand capable of seating 25,000 persons are in course of construction. The feature of special interest to engineers is, however, on the other side of the grounds, where the main building for the reception of the machinery and other exhibits is now being erected. The main hall has a frontage of brickwork 240 feet long, but the rest will all be constructed of iron and glass. The total length of this hall is 1,200 feet, and a special feature in its construction is the employment of old steel rails for the columns, purlins, and rafters, on a plan devised by Mr. H. G. Wynne, the engineer to the company. The whole of the framework is thus made out of old rails, the only portions specially made for the purpose being the cast iron sockets for the columns, cast steel shoes for the connections between purlins, rafters, and columns, and tie bars, which are made of ordinary round iron. There will be six bays of 30 feet each, and one bay of 60 feet. The columns are formed by two rails, riveted together with their flanges, so as to present a cross in transverse section. These are placed into cast iron sockets, which are set upon cement piers sunk in the ground. The outermost columns for the first and last spans are provided with struts, also formed out of rails, fixed to a sleeper, connecting the bottom of the strut with the foot of the column, this provision being made to provide against lateral strains; but the columns of the intermediate spans have no struts. The rafters are also made of rails, placed with the flanges uppermost, those for the short spans being in one length, but those for the long spans being fastened together by fish plates. The usual length of rail employed for the columns is 18 feet and 24 feet. There is a fall in the ground of about 2 feet to both sides from the middle of the building. To avoid the necessity of employing columns of different lengths, the ridge of the roof is carried parallel to the ground, and will therefore also show a fall of 2 feet on each side of the middle. This will be hidden by a loose louver, which is placed all along the ridge, so that the outline of the roof will appear straight and horizontal. The sides of the building will be of galvanized corrugated iron.—*Industries.*

PETROLEUM IN EGYPT.—At Jemsah, in Egypt, in boring for petroleum, ozokerite, or solid petroleum, has been found at a depth of 365 feet, and 15 feet lower a close grained coral has been struck. At another boring, slight traces of gas and oil have also been found.

* See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 579 and 580, for fully illustrated article on this subject.