ENGINEERING INVENTIONS.

An improved pump, having a hollow piston provided with valves, connected with the supply and discharge pipes, and having a cylinder which is reciprocated by a lever handle, has been patented by Messrs. J. Y. Wren, C. Wren, and G. R. Wren, of Plymouth, Pa.

Mr. James L. D. Wolfe, of Windsor, Nova Scotia, has invented an improved ship's pump, in which the piston is reciprocated by a right angled lever operated by a grooved cam.

An improvement in sharpie boats has been patented by Mr. T. Clapham, of Roslyn, N. Y. It is provided with an attachment piece arranged below the water line, and extending from the stem to amidships, to prevent spanking and to enable the boat to always go "in stays."

An improved machine for making open ditches for tile drains and other purposes has been patented by Messrs. James A. Grant and Thomas McClelland, of Mount Pleasant, Ohio. It is mounted on wheels, and operated by drawing it along in the field like an ordinary wagon.

Mr. John McLucas, of Redfield, Iowa, has patented an improved turbine water wheel, which may be arranged on either a vertical or horizontal shaft. It is provided with peculiar chutes and buckets, which cannot be clearly described without an engraving.

ROWELL'S IMPROVED LENS FOR SPECTACLES.

We illustrate herewith an improvement in lenses for spectacles, recently perfected and patented by Mr. J. R. Rowell, of Hill, N. H. Although the improvement is very simple in its character, it is said that it makes a wonderful difference in vision. The lens has two foci, and is therefore capable of forming two distinct images. This peculiar feature will be more readily understood by reference to the engraving, in which Fig. 1 shows the lenses complete mounted in a spectacle frame in the usual way.

In Fig. 2 is shown a diametrical section of the lens, and the direction of the light rays is shown by dotted lines. Fig. 3 is a diametrical section of an ordinary lens.

It will be noticed that in the improved lens the central portion is of long focus, converging the rays at *a*, while the annular portion is of comparatively short focus, converging the rays at *b*.

Mr. Rowell tells us that this lens is adapted to any eye that would be suited by an ordinary lens focusing at any point between *a* and *b*, and that it requires only five sizes, or five different lenses, to fit all eyes met with in the ordinary practice of the optician.

Another feature claimed by the inventor as important is that the field of vision appears to be amply illuminated, and that vision is far more distinct than with ordinary lenses.

Fig. 1

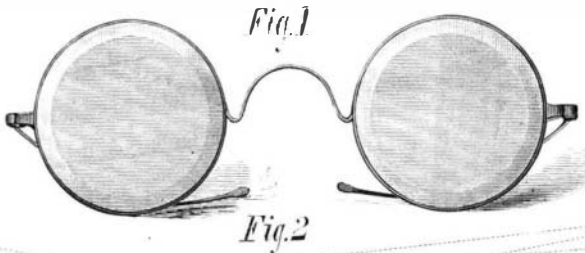


Fig. 2

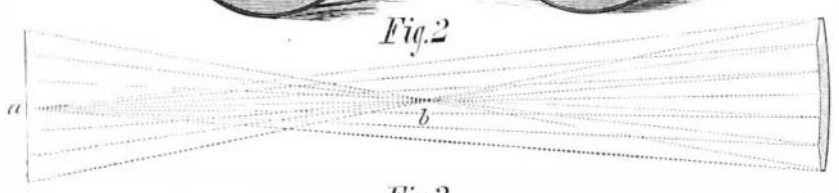
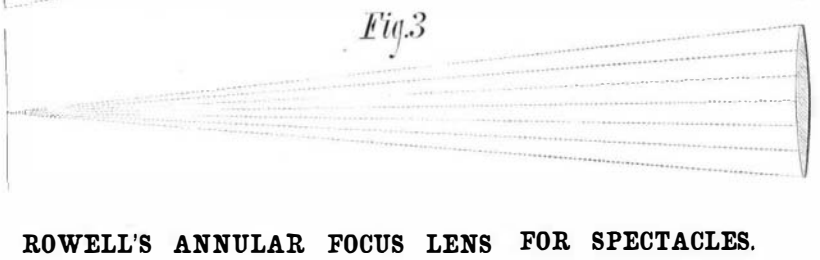


Fig. 3



ROWELL'S ANNULAR FOCUS LENS FOR SPECTACLES.

The Black Mildew of Walls.

At a meeting of the Philadelphia Academy of Natural Sciences, September 3, Professor Leidy remarked that in Hardwicke's "Science Gossip," there is an article by Professor Paley entitled "Is the Blackness of St. Paul's merely the Effect of Smoke?" According to the author of the article, the blackness is mainly due to the growth of a hitherto undescribed lichen, which appears to flourish on limestone and in situations unaffected by the direct rays of the sun. Professor Leidy said that his attention had been called a number of years ago to a similar black appearance on the brick walls and granite work of houses in narrow shaded streets, especially in the vicinity of the Delaware river. Noticing a similar blackness on the bricks above the windows of a brewery, from which there was a constant escape of watery vapor, in a more central portion of the city, he was led to suspect that it was of a vegetable nature. On examination, the black mildew proved to be an alga, closely allied to what he supposed to be the *Protococcus viridis*, which gives the bright green color to the trunks of trees, fences, and walls, mostly on the more shaded and northern side, everywhere in the vicinity of Philadelphia. It may probably be the same plant in a different state; but, until proved to be so, may be distinguished by the name of *Protococcus lugubris*. It consists of minute round or oval cells, from 0·006 to 0·009 mm, in diameter, isolated or in pairs or groups of four, the result of division; or it occurs in short, irregular chains of four or more cells up to a dozen, occasionally with a lateral offset of two or more cells. The cells, by transmitted light, appear of a brownish or olive-brownish hue. In mass to the naked eye the alga appears as an intensely black powder.

CATILLON, a French physiologist, found that the addition of from seven to eight grains of glycerine to the daily ration of a lot of Guinea pigs increased the effect of their food so that they gained from one-tenth to one-fifth of their weight in a given time, while a second lot fed on the same ration, but without glycerine, gained nothing; when the dose of glycerine was changed to the second lot they gained in weight, and the first lot gained nothing. Large doses of glycerine, however, cause derangement of the digestive organs.

THE EXPLOSION ON THE THUNDERER.

The bursting of the 35 ton gun on the British war vessel Thunderer, during target practice on the morning of 2d of January last, with the attendant loss of life, was widely noticed at the time.

From the report of the joint committee appointed by the Admiralty and War Office to inquire into the cause of the disaster, it appears that the two guns of the fore turret of the Thunderer and the two guns of the after turret were each loaded with a battering charge of 110 lb. and with an empty Palliser shell. In the case of the fore turret disk wads were used; but in that of the after turret (where the guns, being only of 35 tons weight and of 3 feet less length than those of the fore turret) the guns were loaded by hand from within the turret, and wads were not used, the water being smooth and the guns horizontal. All four guns, being primed with electric tubes, were coupled up electrically so as to be fired from the "conning tower," to deliver what is known as an electric broadside. The target at this time was about 400 yards distant and the ship was under steam. On the firing key being pressed to fire this broadside, although the tube of the right gun in the after turret was exploded by the electricity, the fire was not communicated to the powder in the cartridge, and that gun admittedly made a misfire. The committee have been forced to the conclusion that the left gun of the fore turret also missed fire. After the electric broadside the order was given for independent firing with empty common shell and full 85 lb. charges. Both guns of the fore turret were thus loaded. The right gun was then fired independently; the left gun of the fore turret was then fired and burst explosively. The causes which may have led to the explosion are summarized by the committee as follows:

"(*a*) That the gun being sound, and being used in a normal manner, burst because it was inherently too weak (1.) The weakness arising from faulty design. (2.) The weakness arising from bad materials. (3.) The weakness arising from bad workmanship. (4.) The weakness arising from a combination of any or all of the foregoing causes.

"(*b*) That the gun, not being inherently too weak, had been injured by previous cracks, and was thus rendered unsafe to fire the 85 lb. charge.

"(*c*) That the gun, being neither inherently weak nor previously injured, was burst by the projectile becoming jammed in the gun. (1) Jammed by the wad; (2) jammed by the studs; (3) jammed by the breaking or by the 'setting up' of the projectile.

"(*d*) That the gun being assumed perfect as above, the bursting was caused by an air space being left either between the cartridge and the breech end of the bore, or between the cartridge and the projectile, or by both, such air space being caused—(1) by the charge not having been rammed completely home; (2) by the projectile having come forward, either in consequence of the wad having been withdrawn or being inefficient.

"(*e*) Error in loading—viz., that the gun being assumed perfect, the gun had been loaded with an empty common shell and full charge, and it had been ascertained by the priming wire, after the gun was brought to the horizontal position, that the charge was not home, and that, therefore, the gun was again brought to the loading position for the mere purpose of re-ramming, but the only visible signal between those inside of the turret and those on the battery deck being 'sponge and load,' this signal was literally obeyed, and a second common shell and 85 lb. charge were rammed in on the first such charge, which still remained in the gun.

"(*f*) Also error in loading—viz., that the gun being assumed perfect, the explosive bursting was due to the battering charge and Palliser shell remaining in the gun, owing to a misfire at the electric broadside, and to the insertion into the gun of the full charge and common shell in addition to the battering charge and Palliser shell, and to the gun being fired at the independent round when thus doubly loaded."

The committee unanimously report in favor of the last (*f*) as the true cause of the explosion. The report says:

"Assuming the gun to be fired under these circumstances, the battering charge would be ignited by the tube, and the flame from this, before the expansion of the 'gas check' fully took place, passing forward would almost instantly ignite the full charge. At that time, however, the ignition of the battering charge would have driven the Palliser shell forward, and have violently compressed the full charge in front of it, and probably have driven it somewhat forward in the gun, and thus the point of maximum effort of the exploded compressed full charge would have been just about in the center of the 1 B coil—namely, 90 inches from the breech end of the bore. An explosion of 85 lb. of powder thus compressed and having a shell in front of it occurring in this place would unquestionably be sufficient to burst the gun."

That the second charge was exploded by fire from the first, Prof. Osborne Reynolds thinks highly improbable. In a paper read before the Manchester Philosophical Society he pointed out that the bursting of the gun like a shell in front of the first shoulder implied an enormous excess of pressure at this point of the gun, an action such as might result from guncotton or dynamite, but which could not be produced by the slow burning of pebble powder.

The reason why guncotton is so much more destructive than gunpowder is not that it gives off more gas, weight for weight, but that when ignited by a flash it burns so much quicker. If, therefore, by any means the whole mass of gunpowder in the forward charge had been heated up to the firing point at the same instant, so that the grains fired simultaneously inside as well as out, the action of the powder would have been as quick or quicker than the guncotton. And, still further, if besides being heated the powder was compressed into a fraction of the space it usually occupies, the gases so confined would have been capable of a still greater pressure.

That this was the real condition attending the explosion Prof. Reynolds showed to be altogether probable. He said:

"Now if the after cartridge were fired and the forward cartridge were not ignited by the flash, and considering the length and fit of the shot, it could hardly have been so ignited, then the after shot would be driven forward, closing on to the forward shot and compressing the powder between until the pressure on the forward shot was at least half as great as the pressure of the gases behind the after shot, which would be between ten and twenty tons on the square inch. Thus the powder would be subjected to a squeeze between the two shot such as would result from a blow. It would be compressed to a fraction of its former volume. The cubes would be crushed into a cake and the work of compression would be sufficient to heat the powder beyond its point of ignition. Thus the entire mass of powder would be simultaneously ignited in a highly compressed and heated state. The force of such an explosion would be practically unlimited and would be located at the very point at which the gun burst. Hence in such an action we have ample cause for the effect produced."

To test this theory of the explosion Prof. Reynolds suggested that a 12 inch gun be loaded with a double charge of powder and a double charge of shot, or a shot of double weight, and fired. If, as was probable, the gun did not burst, confidence in the gun would be re-established. Then let the gun be loaded twice over with the powder between the shot so as to ascertain whether the action of the powder when fired by percussion would not produce an effect similar to that which caused the explosion. "The destruction of one gun for the purpose of establishing confidence in all the rest," Prof. Reynolds added, "would not seem to be an unworthy sacrifice."

Geological Survey of Kentucky.

We have received from the Director of the Kentucky Geological Survey, Prof. N. S. Shaler, the following reports: On the Timber Trees of the Tradewater Region, by L. H. De Friese; On the Timbers of the Purchase District, by the same; On the Cumberland River (Limonite) Iron Ores, by Wm. B. Caldwell, Jr.; On Coal Washing for the Separation of Coal from its Impurities, by P. N. Moore.

These reports, particularly the two last named, will be found of value to all interested in the development of the resources of Kentucky. The limonite ores of this State are not only abundant, but particularly valuable for steel making. Coal of excellent quality abounds in the same region.

Antwerp Industrial Exhibition.

Mr. James R. Weaver, United States Consul at Antwerp, informs the Department of State that an industrial exhibition will be opened in Antwerp in August, 1879, which will be worthy of universal attention. Space has been allotted for American products. The consul commends the exhibition to the artisans and producers of the United States. Correspondence may be opened with and consignments sent to S. H. Haine, No. 39 Rue Honblonniere, Antwerp, Belgium, who will take charge of American goods. He has already received a number of consignments to his care from the United States. Goods should be in Antwerp before the first day of August next.