## TERRIBLE GUN COTTON EXPLOSION AT STOWMARKET, ENGLAND.

The wholesale destruction of life and property by explosive agents which characterizes the present time, may well lead to the inquiry whether this sacrifice is demanded by the exigencies of modern civilization. Steam, gunpowder, nitroglycerin, dynamite, gun cotton, lithofracteur, these are the powerful genii invention has summoned to obey human will. But they are latterly showing that they can disobey, and take every opportunity to disobey, unless constantly guarded by the most rigid surveillance. Some of these, indeed, have a habit of going off without any apparent neglect on the part of those who use them. What a chapter of horrors the last two years has furnished! and now from England comes another which has not only destroyed many lives and much property, but has taught that we really know little of the nature of explosions, since one of the explosions occurred in a manner supposed to have been proved impossible by a long series of Government experiments. From *Engineering* we gather the following facts:

A most lamentable explosion occurred at Stowmarket, England, on Friday, August 11. The works of the gun cotton manufacturing company, in which Messrs. Prentice are the principal partners, are situated on a stretch of meadows about three quarters of a mile from the town of Stowmarket, in a northeasterly direction. On this strip of land were the mixing or dipping, and the drying sheds, in which the cotton is passed through the chemical solutions and dried. At the southeastern end of the grounds stood three magazines, about 12 feet long, 10 feet deep, and 8 feet high. The sides were constructed of wood, lined with canvas and paper on the interior, and the roofs were lightly covered in with slate. The magazines were built on wooden piles, and were placed 14 feet from each other, and between them were 9 inch brick walls rising higher than their roofs. They had neither windows nor skylights, the only openings being the single door in each. They were used to store the finished gun cotton until sent away from the works. At the time of the explosion each magazine contained about five tuns of thematerial, part of an order which was being executed for the English Government. At the northeastern end of the works, and about 900 feet from the three magazines, is a building similar in character to them, used as a store for rifle cartridges. About 130 hands, men, women, and children, are employed in the establishment, and they had just resumed work after the dinner hour, when a fearful explosion occurred on the site of the three magazines to which we have alluded. To those on the works who are able to give any account of the occurrence, there appeared to be but one explosion, while in the town of Stowmarket, three distinct explosions were heard to follow each other in very rapid succession. The work people rushed from the tottering sheds around, only to be killed or injured by the falling *débris*.

Soon after the explosion, Mr. E. H. Prentice, one of the directors, and who is the manager of some neighboring chemical works, and Mr. W. R. Prentice, second son of Mr. Manning Prentice, were on the spot. They proceeded to collect the workmen, and with them set to work to save such of the buildings as still remained, but which had taken fire. Relying on the results of some experiments which had been carried out to prove the gun cotton, as now manufactured, to be non-explosive except by percussive fire, Mr. E. Prentice was engaged in removing boxes of cartridges from the flames, being assisted by his nephew. Although warned of danger, he still continued his fatal work, when one of the boxes exploded. This explosion completed the fearful work of destruction, and the remainder of the works was rendered an easy prey to the flames. The latest accounts place the number of persons killed by the disaster at 24, the number of wounded being 72, and it is possible that some names in the latter may go to swell the former list.

[For the Scientific American.]

## THE SURF.

BY CHARLES MORRIS, OF PHILADELPHIA.

How many of the great army of pleasure seekers who have this summer wandered upon the sea beach, have seen any mystery in the breaking of the surf, or questioned the origin and character of the mighty force there displayed? Probably not one in a thousand has considered the subject worthy a thought, and not one in ten thousand has understood it. Of course, all have a general idea that the surf originates in the dashing of the wave upon the beach. But a wave is a simple elevation and depression of the surface of the water, without any permanent forward movement; the surf, on the contrary, is a permanent forward movement. The question arises, how the one condition is changed into the other.

The seeming forward motion in the waves is simply the progressive motion of the force that produces them. This force exerts itself on successive portions of the water, one rising as the other sinks to rest. Each particle of the water, after describing a vibratory or circling path under the impulse of this force, comes to rest at the center of its motion while the force, traveling onward, disturbs new particles. Thus the quantity of force remains permanent, while the locality constantly changes.

This force tends to produce motion in all directions, and moves forward from the fact that a continuation of the wave motion resists its backward movement. It has also an effect on the water below the surface, acting downward until the accumulated resistance balances the motive force: the effect of this resistance being aided by the greater facility of surface propagation.

It is this downward influence of the wave force to which the phenomenon of the surf is due. The wave, traveling shoreward, in time reaches water so shallow that the downward impulse of the force extends to the bottom. Thus the elastic resistance of water is exchanged for the rigid resistance of the solid bottom, and the force is reflected upward. It is this elastic reaction that lifts the water, the wave being prevented from having its full extension downward. As the water grows shallower this effect increases, so that the waves rapidly increase in hight.

But now the bottom of the wave is dragging, as it were, upon the sand. Thus a frictional resistance hinders the ready communication of force from particle to particle at the bottom, and the onward motion of the wave force is delayed. This resistance of friction has little or no effect on the surface particles, its influence continually decreasing upward. Hence the wave force is now moving onward more rapidly at the surface than at the bottom. The wave, in consequence, slants forward, eventually toppling over from the force of gravitation.

Now the motive force of the wave, which has hitherto been communicating itself regularly from particle to particle of the water, is prevented from doing so by this disturbance of the regular vibratory motion. It, therefore, acts with its full progressive vigor on the portion of water last affected, driving it bodily forward, until the force is balanced by the counter effects of gravitation and friction. The wave force thus eventually becomes changed into the heat of friction, or is partly employed in abrasion of the sands, and partly in producing the potential energy of lifted water.

The surf, where the wave breaks upon a bar, is similarly caused. But the water which is dashed forward by the propelling force, meeting deep water within, experiences an elastic resistance to its forward motion. It is thus brought to rest, and its movement communicated to the water in advance. Thus a continuous communication from particle to particle recommences, and the wave is reformed. Of course, the friction upon the bar employs a portion of the force, the quantity of which lost force depends upon the shallowness of the water. Hence the wave is always lower inside the bar.

In case the surface of the bar reaches very near the surface of the water, the friction uses up nearly all the propelling force of the wave, and the water within is nearly or quite smooth.

What an immense force is thus, day after day, and century after century, expended as friction upon the sea beaches of the world, employed in grinding solid rock into the huge accumulations of sand found every where throughout the earth!

### The Effect of Sun on the London Asphalt Roads.

Should we be favoured with a continuance, or an accession in intensity of the summer heat, the watering cart or hose will be as necessary appendages for maintaining the solidity of our new roadways as they are in laying the dust on our old ones. A plastic asphalt surface is in no wise desiderated or coveted for vehicular traffic, and it would be an unfortunate event if, after all the cost, obstruction, and delay that have attended the introduction of our latest, and still most useful road material, to find it fail in the most useful essentials, namely, the retention of its hardness and body, under all conditions of the atmosphere. After all, the hot weather may not have come in vain, if it gives us a good and timely opportunity to benefit by its occurrence, in the improvement of our road construction, and in the better selection and manipulation of the present and similar material for the future. Experience teaches, it is said; but the right of way is often blocked by vested interests, which neither shower nor sunshine has been found to materially affect. In the present instance perhaps the power of the sun will turn men's minds nearer to a conviction of the truth than the power of the pen, and those who more immediately interested will improve and profit accordingly. We need scarcely say that our remarks are not made in disparagement of the asphalt pavement, but as a hint to further practical efforts for the direction of improvement.—*Builder.*

### Manufacture of Telegraph Cables.

Mr. Henley's works at North Woolwich, Eng., cover fourteen acres in extent, employ at present only 1,100 to 1,200 hands—being rather slack—2,000 being the normal number, and can turn out at present some 100 miles of cable weekly, with prospective power of increasing that quantity to 250 miles; it thus will be seen that this is a factory of no ordinary kind or magnitude. In the core there are six copper wires stranded around a central one, making seven in all. These are tinned over, and completely sheathed with an insulating covering, varying in material and thickness, either simple or compound; in the former case being composed entirely of gutta percha in a solid mass, in the latter, of felted tape wound round the wire in two bands in opposite directions, and finally encased under compression by rollers, with a thin seamless sheathing of india rubber (or similar material). Of the two, the latter is by far the most perfect insulator or mode of insulation, whereas the former has hitherto had the preference, from considerations of cost; but now it is believed that the superior material, india rubber, can be brought into successful competition with its cheaper and inferior rival, even from a financial point of view. The core so prepared in either way, has then spun around it two successive yarn sheathings, in numerous strands, varying according to the purpose in view, which supply a bed for the true cable, in point of strength, as contrasted with the electric cable element, the core. Round the whole are spun or twisted stout galvanized iron wire strands, also of varying number and size, as may be required, over which again are wound, in opposite directions, two fine strands of jute yarn, firstly with a resinous compound containing silica, and ultimately with a seething tarry compound, cooled and hardened, by a stream of water, in the gripe of a set of roller wheels, compressing and finishing off the whole. Whence issuing, the cable is coiled within the tanks, in successive rings and layers. The method of applying the asphalt coating by means of bucket wheels or turbines, in reverse operation, is most ingenious, effective, and noteworthy.

The description applies to the formation of a single cable, as well as to a multiple cable, with this difference, that in the latter case several of the insulated cores of stranded tinned copper wire are twisted in combination with other strands of yarn into a compound core, which then receives the outside sheathings of yarn and galvanized iron wire.

A remarkable feature about these telegraph works is that they are almost entirely self contained, so that nothing is required beyond the raw materials worked up in the manufacture, the metals, iron, copper, and zinc, the acids and chemicals, the jute yarn, and the insulating substances. The drawing of the wire, the annealing, acid cleansing, galvanizing and drying thereof; the stranding of the core; the preparation and completion of the insulating sheaths—every initial intermediate, and ultimate stage is conducted and carried on, every process provided for and executed; and all the machinery for the purposes, and even much of the very buildings which cover and contain the work, is manufactured and put together on the premises excepting prime movers.

The motive power is mainly obtained from duplicate 75 horse power horizontal steam engines, of the ordinary type with some special features.

### Improved Miter Box.

Mr. George E. Hedges, of Ashland, Nebraska, has invented an adjustable miter box, designed to improve the means for maintaining miter saws in their true position. A bed plate sustains a semicircular platform on which the piece to be sawn is laid. A flange on the straight side of the platform, forms an angle for the piece to rest in, as that of all miter boxes. This plate or platform is pivoted at the center of the circle to the bed plate. The box turns on this pivot, and may be secured on the bed in any desired position, so as to saw a piece of wood at a true miter or any other angle. The saw line passes at a right angle across the bed and directly through the central pivot. There are two uprights at each end of the saw line, connected together at top and bottom, but in such a manner that one of each pair is adjustable toward or from the other, so that the saw guides may be made to suit saws of different thicknesses. These guides are connected together at their top ends, and are attached to the uprights so as to slide up and down and govern the saw. A saw back is attached, between the guides at their upper ends, to the saw by a set screw, and supported in position by two arms, of which the first receives the saw near the handle, and the second is adjustable on the back. The saw and back being thus attached, the teeth are thrown below the guides to prevent injurious contact with the metal. The upright posts and guides are made of metal, and are consequently not liable to get out order like miter boxes made of wood. The guides with the saw back are suspended from the top of the uprights by light springs, but so that while their weight will be supported, the saw will work down into the wood with but slight pressure. We regard this as an excellent invention simple and practical.

### Ripping Tool.

This invention relates to a new and useful tool for ripping seams sewn in cloth and for other purposes. This tool is a small flat instrument, of steel or suitable material, with a wide notch in one end, in which a oblique knife edged cutter and a clearance for the shreds are formed on the bottom of the notch, while prongs or projections at the sides of the notch form guides for keeping the seam to be ripped on the knife edge, each guide being different from the other, and adapted for a seam differing in some respects from what the other is adapted to. The handle or stock of the instrument is provided with a notch adapted for use as a wrench; also a hook and a niche, whereby the said implement is adapted for several uses in connection with sewing machines; the object of the invention being to provide a simple and efficient implement which will act by a shear cut, instead of the direct jam cut common to other ripping tools, in which the cutting edge is presented perpendicular, or nearly so, to the seam; and also to adjust the seam or cause it to assume the proper relation with the cutter as it is brought to the cutting edge. This handy little instrument is the invention of Justus O Woods, of New York City.

HAND TURNING.—The Company of Turners, in London, purpose to establish an annual prize for technical skill. The prize will be in the form of the company's silver medal and and the freedom of the company and of the City of London, and will be given for the best specimen of hand turning in the yeor. This year the competition will be in turning in wood. It is provided that the specimens shall be delivered at the Mansion House in the first week of October, and that they should not exceed 18 inches in hight and 1 foot in diameter.

PROPOSED TEST FOR STEEL AND IRON.—Mr. H. A. Walker, of Tarboro', N. C., proposes that the scintillation of iron and steel filings, when put in a fire, be made use of to test the quality of the metal. The different degrees of brilliancy, as well as the readiness with which the filings sparkle in the fire, are suggested by Mr. Walker as proofs of the varying purity of the iron or other metal. The test is handy and convenient, and might be of some practical value.