of sodium being formed upon it; but at ordinary temperature, the oxygen of the air has not the least action upon charcoal. Sodium, again, will decompose water in the cold; but charcoal will not effect the same decomposition below a red heat. As it is only when in contact with water that sodium is supposed to explode, let us see what really takes place when sodium comes in contact with that element. The sodium is so light that it floats upon water, and its affinity for oxygen is so intense that it instantly decomposes that compound, combining with its oxygen, and setting its hydrogen free. If you throw upon water a small piece of sodium, say of the size of a small pea, you hear a hissing noise at the instant of the piece of sodium coming in contact with the water, and what you see is a white globule, floating very rapidly to and fro, and gradually diminishing in size until at length it disappears. This hissing noise continues as long as the white globule is visible, but of course diminishes in intensity as the globule diminishes in size. This hissing noise is caused by the great heat developed by the combination of the sodium with the oxygen of the water, together with the further heat developed by the combination of the oxyd of sodium so formed and with an equivalent of the water itself, to form hydrate of sodium; and the white appearance of the globule is due to its being constantly incrusted with this compound. The incrustation of hydrate of sodium dissolves nearly as fast as formed, enabling the water continually to reach fresh free sodium, and so continually to form more hydrate, the process going on until all the sodium has combined with oxygen and water to form hydrate, and all the hydrate has been dissolved. If the piece of sodium employed is only of the size indicated above, the process goes on quietly, and nothing of the nature of an explosion occurs at any stage of it; but with a large piece of sodium the case is somewhat different. The heat developed is then so great that not only do both the liberated hydrogen and the sodium itself take fire, but the hydrate of sodium that is formed fuses, and so comes in contact with the water at nearly a red heat, and the result is that steam is generated in any crevices that there may chance to be in the coating of intensely heated hydrate which surrounds the lump of floating sodium, with such violence as frequently to shatter the lump to pieces, sending fragments of burning sodium flying about in every direction. Still, the explosion is clearly one of steam, and not of sodium, and is, indeed, simply of the nature of the explosion which would take place if water were made to penetrate into crevices in the interior of a mass of incandescent coal. The *Pall Mall Gazette*, however, evidently regards sodium has being itself explosive, just as gunpowder is—only it thinks sodium by far the more powerful explosive of the two.—*Mech. Mag.*

M. Pleateau's experiments show that the muscular force of insects compared with that of the vertebrates is enormous. The common cockchafer is capable of exerting a tractile force equivalent to fourteen times the weight of his body, while the drawing power of a horse is only ·67 of his weight.

Machinery and Manufactures.

SIR W. ARMSTRONG'S WATER-PRESSURE ENGINES.

The London *Engineer* of May 25th, contains an illustrated description of a water-pressure engine by Sir Wm. Armstrong, the inventor of the celebrated *Armstrong gun*. A description of these engines, as applied to cranes on the Newcastle docks, and at the docks at Great Grimsby and Birkenhead, the opening and shutting of locks of canals, &c., was given in Vol. IV of this Journal, page 48. The improved engine now referred to is thus described:—

"The engine illustrated, is supplied from an artificial head obtained with Sir Wm. Armstrong's accumulator, which has been fully described in recent numbers of *The Engineer*, with a working pressure of 700 lbs. to the square inch. The immense pressure thus at command enables the required power to be applied with a comparatively small engine; the engine only occupying a space of four square feet. A natural head is seldom met with sufficiently high to give the above-named pressure, but in mountainous districts a head of from 200 feet to 300 feet is often met with. The power derivable from a stream at this, or at a much lower height, could be very advantageously applied to various purposes by water-pressure engines.

Sir W. Armstrong has very wisely considered the necessity of producing, and we are glad to see he has produced, an engine which gives very satisfactory results, with pressure derived from natural heads. This mode of working admits of the water being stored up in reservoirs, from which it can be conveyed any distance to the locality where it may be required. At some lead mines in a hilly district at Alleuheads, Northumberland, Sir W. Armstrong many years ago erected water-pressure machinery deriving its supply from the hills, and applied to the purposes of draining the mine, raising, crushing, and washing the ore, with complete success.

In 1842, Mr. J. Darlington designed and erected at the Alport mines, Derbyshire, a direct-acting water-pressure engine, with a cylinder 50 inches in diameter; stroke, 10 feet; with a pressure column of 132 feet; average speed, four strokes per minute; total pressure on the piston, fifty tons. Mr. Darlington employed a double system of valves to admit the water gradually, for the purpose of producing smoothness of action. Sir W. Armstrong's system of "relief valves," which has since been introduced, has removed a great practical barrier which previously retarded the development of this kind of mechanism.

The principal improvement introduced recently is the mode of rendering it double-acting, which has superseded the single-acting engine by dispensing with one of the three cylinders and bringing the force to bear four times in the crank circle instead of three. The cylinders, which are placed far enough apart to put a winding drum or a gear-wheel on the crank-shaft, are made to oscillate; and the plungers are attached directly to the crank-pin; and a piston is formed at the inner end of