The piston is so constructed as to contain a quantity of oil, which continually lubricates the cylinder at every stroke. Air is contained in a sphere of elastic rubber within the air vessel, which prevents its total absorption. The internal diameter of the suction-pipe is five inches; the internal diameter of each of the two delivery-pipes is three inches. The weight of this engine with running gear complete is three and a-half tons. Steam can be raised from cold water to a pressure of forty pounds on the square inch in ten minutes from the application of the match. It has drawn water through the suction pipe vertically a distance of fourteen feet, and then discharged it over a building sixty feet high to a distance of 210 feet through an inch and a quarter nozzle. The engine named the "Torrent," by the same makers, differs in a few details, and can be easily drawn by one horse. The steam cylinder is 61 inches diameter, with a 12-inch stroke. The pump is double acting, the same as used in the "Deluge," is 43 inches diameter, with a stroke of 12 inches; the two piston-rods being coupled directly, air-vessels are placed both on the suction side as well as on the deliveries. At a recent trial, cold water being used, a pressure of 37 lbs. of steam was raised in 8 minutes, and 100 lbs. in 94 minutes from the time of applying the match, and it is capable of discharging 250 gallons of water per minute to a beight of 160 feet.

Mr. William Roberts, of Millwall, has constructed a very useful steam fire-engine, which can also be used as a hoist. The engine is 12 feet 6 inches long, by 6 feet.4 inches broad ; the steam cylinders. two in number, are 6 inches diameter by 12 inches stroke, placed immediately in front of the boiler and over the shaft. The driving wheels are five feet diameter and each wheel has 2 springs, all being within the framing. The moving power is transmitted to the wheels from the main shaft, by a pitch chain gearing, 4 to 1; either wheel can be thrown in or out of gear at pleasure by means of a The steering-wheel is 3 three feet diameter, clutch. and will lock quite round, enabling the engine to turn completely round in its own length. The pumps are two of Mr. Roberts's Patent, 94 inches diameter, with a stroke of 8 inches each pump, and they can be very readily connected to the engine or thrown out of gear. The boiler is Benson's Patent, with water tubes, and forced circulation. The engine will carry 60 gallons of water in the tanks, 5 cwts. of coal, 24 feet of ladder (4 feet 6 inches in lengths), 12 feet of suction hose (24 feet if wanted), 40 feet of 4 inch delivery hose, and 450 feet of 2½ inch ditto, 1 large and 4 small branch pipes, 12 buckets, and all the necessary tools, &c., the weight complete being 7 tons 15 cwts. On the end of the main shaft is a rigger, 2 feet in diameter, and a small windlass end to enable it to be used for driving machinery, hoisting, &c., and these are included in the weight of 7<sup>3</sup>/<sub>4</sub> tons. Steam can be fairly got up to 140 lbs. per inch in 19 minutes 25 seconds, with all coal, no wood being used except to light the fire in the first instance. With a 1 inch jet it has thrown the water a distance of 186 feet, and with a 14-inch jet a height of 140 feet; it is fitted with a regulator, so that it can be made to deliver the smallest quantity; with a jet  $\frac{1}{54}$  th of an inch it took 12 minutes 45 seconds to fill a quart

jets instead of one large one when desirable to  $d_0$  so, and will deliver 450 gallons per minute. It has been propelled at a rate equal to 18 miles an hour, and has been taken through the High-street, Poplar, at from 12 to 14 miles an hour; it has ascended inclines of 1 in 14 with the greatest ease. stopping in the middle and starting again without difficulty. It has also been run over fresh Macadam road, and upon one occasion was taken to Woolwich and brought back, about three miles of road each way that had only just been made good from put. ting in the main sewer, the wheels sinking sometimes to a depth of 12 inches.

I have another engine to describe, and that shall be done in a few words. It is one invented by Mr. Wellington Lee, of the firm of Lee and Larned, of New York, and manufactured in this country by Messrs. Easton, Amos and Sons, of Southwark. The boiler is of novel construction, and is composed of gun metal, steel and Lowmoor iron, with a view of obtaining the two essentials of lightness and compactness, securing at the same time a large amount of heating surface, of which there are 228 5 square feet, and of fire-bar surface 4 58 square The boiler is composed of a central furnace, feet. surrounded by a shell, or wall, of vertical watertubes, surmounted by a steam-drum, which, in ordinary work, is filled with water to about one-third of its height; and from this chamber depends a flat water space, or "suspended slab," the connection with the steam drum being made by a series of vertical tubes. Through these proceed internal tubes by which the products of combustion pass in an intensely heated state to the smoke-box, exposing by this means an annular water space to the action of the heat. A number of short tubes pase independently of these, through the suspended slab, and the steam drum respectively, through which the heated current also passes; and the entire arrangement is so adapted as to present the greatest possible amount of heating surface obtainable to the action of the fire. Tubes pass from the suspended slab to the water-bottom, into which the bottoms of the outer shell of tubes are secured, thus maintaining a complete circulation of the water throughout the boiler. The steam cylinders are two in number, and are placed immediately forward of the boiler; their diameter is 9 inches with a stroke of 94 inches, the two piston rods are coupled The slide valve of one cylinder is actuated direct. by means of a reducing lever placed on the pistonrod of the other cylinder, and operates in such a manner, that when one piston is at the end of the stroke, the other is at half stroke, and vice versa. This arrangement while ensuring the correct action of the slides for admitting and exhausting the steam, is not of itself sufficient to ensure the proper length of stroke, but avoids the breaking of piston or cylinder cover which might perhaps occur. To guard against this, two additional parts are provided, so arranged, that the exhaust is imprisoned shortly before the termination of the stroke, and the piston starts smoothly and evenly on its return, and however rapid may be the running, the motion is as certain and even as in two engines working with cranks at right augles upon one shaft. The pumps are two in number, each 5# inches diameter; but the plungers and seats may measure. It can be made to use 2, 3, or 4 small | be changed in about twenty minutes for others of

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