stroke to it. It is, indeed, generally said to be an improvement to Mr Savary's engine ; but I am well informed, that *Mr Newcomen was as early in his inven­tion as Mr Savary was in his,* only the latter being nearer the court, had obtained his patent before the other knew it, on which account Mr Newcomen was glad to come in as a partner to it.” Dr Desaguliers speaking of Savary’s engine also says, “ these discouragements (the difficulty of making sufficient high-pressure boilers, &c.) stopped the progress and improvement of this engine till Mr Newcomen, an ironmonger, and John Cawley, a glazier living at Dartmouth, brought it to the present form in which it is now used and has been near these thirty years.” (1744.) *Experimental Philosophy,* ii. 467. And again, “ about the year 1710, Thomas Newcomen, ironmonger, and John Cawley, glazier, of Dartmouth, in the county of Southampton, (Anabaptists,) made then several experiments in private, and having brought it to work with a piston, &c., in the latter end of the year 1711, made proposals to draw the water at Griffin War wickshire ; but their invention meeting with no reception, in March following, through the acquaintance of Mr Potter of Bromsgrove, in Worcestershire, they bar gained to draw water for Mr Back of Wolverhampton, where, after a great many laborious attempts, they did make the engine work. They were at a loss about the pumps, but being so near Birmingham, and having the assistance of so many admirable and ingenious workmen, they soon came to the method of making the *pump-valves, clacks, and buckets ;* whereas they had but an im perfect notion of them before. One thing is very re markable. At first working, they were surprised to see the engine *go* several strokes and very quick together, when, after a search, they found a hole in the piston which *let the cold water in to condense the steam in the inside of the cylinder,* whereas, before, they had always done it on the outside. They used before to work with a buoy in the cylinder inclosed in a pipe, which buoy rose when the steam was strong, and opened the injection pipe and made a stroke, whereby they were capable of only giving six, eight, or ten strokes in a minute, till a boy named Humphrey Potter, who attended the engine, added what he called *scoggan, by which the beam* ***of*** *the engine always opened and shut its own valves,* and then it would go (entirely without the attendance of a man) fifteen or sixteen strokes in a minute. But this being perplexed with catches and strings, Mr Henry Beighton, in an engine he had built at Newcastleon-Tyne in 1718, took them all away, *the beam itself supplying all much better.* The way of leathering the piston was found by accident about 1713. Having screwed a large broad piece of leather to the piston, which turned up the sides of the cylinder two or three inches : in working it wore through, and cut that piece from the other, which, falling flat on the piston, wrought with its edge to the cylinder, and having been in a long time, was worn very narrow, which being taken out, they had the happy discovery whereby *they found that a bridle rein or even* a *soft thick piece of rope Or match going round, would make the piston air and water tight."*

This short note of Dr Desaguliers, who, with Switzer, is our authority for the historical facts of this date, con tains the leading points of the history of the steam engine as generally used for raising water during the eighteenth century. Newcomen gave to the engine a *cylinder* and *piston :* he formed *a vacuum in the cylinder below the piston,* by first admitting steam from the boiler so as to expel air and balance the pressure of the atmosphere, nn∣l afterwards *condensing the steam* so as to re­duce it hack to its primitive hulk of water, and thus, by leaving the space below the piston empty, allow *the pressure of the αtmosphere upon the whole surface of the*

*piston* to carry it with a force somewhat less than fonr teen pounds on each inch of that surface downwards to the bottom of the cylinder, so that by suspending the piston with a chain from the end of a *rocking beam* to the opposite extremity of which the *rod and buckets of a large draining-pump* were attached, a considerable volume of water was raised at each alternate ascent and descent of the piston, which was raised up again by the weight of the pumps and water, at the other end, whenever the steam was readmitted below the piston to balance the atmo sphere—he gave to the *valves, clacks, buckets,* &c., that *improved mechanical construction* which rendered them suitable to the precision of the action of steam. He first constructed a *piston with an elastic packing* of hemp, by which it is kept steam and airtight as it moves along the cylinder; and, above all, availed himself of the experience of an unlucky accident to add the important process in the steam-engine of *condensation of steam by injection of cold water* directly amongst it. All these in­ventions of Newcomen give to the steam-engine of the present day its most important features ; and if we add to these the *scoggan* or *sculking gear of Potter, by* which the attendant of the engine was enabled to scog or *sculk* from his work, leaving *the engine itself,* by an ingenious complication of strings and catches to do his work, *Opening and shutting its own valves,* with much greater *precision, quickness, and regularity,* than the listless at­tendant had ever exercised or even the very closest attention could attain ; and if, further, we include the ingenious and more permanent *mechanism which* Beigh ton *introduced* as a substitution for the rude expedients of strings and straps ; and, finally, if we include the *admirable proportions and constructions, and adaptations* of all the various parts of the engine to each other, and to the boilers and furnaces, and of these to the nature of the work to be done, as displayed in the magnificent atmospheric engines of the sagacious and philosophical Smeaton, we shall comprehend, in this succinct view, all that had been done for the steam-engine previously to the time of Watt.