is the great beam. The enormous ſtrains exerted on its arms require a proportional ſtrength. This requires a vaſt maſs of matter, not leſs indeed in an engine with a cylinder of 54 inches than three tons and a half, moving with the velocity oſ three feet in a second, which muſt be communicated in about half a ſecond. This maſs muſt be brought into motion from a ſtate of reſt, muſt again be brought to rest, again into motion, and again to rest, to complete the period of a ſtroke. This confirmes much power ; and Mr Watt has not been able to load an engine with more than 10 or it pounds on the inch and preſerve a sufficient quantity of motion, ſo as to make 12 or 15 six-feet ſtrokes in a ſecond. Many attempts have been made to leſſen this maſs by tiling a light framed wheel, or a light frame of carpen­try, in place of a ſolid beam. These have generally been conſtructed by persons ignorant of the true ſcientific principles of carpentry, and have fared according­ly. Mr Watt has made similar attempts ; but found·, that although at firſt they were abundantly ſtrong, yet after a ſhort time’s employment the ſtraps and bolts with which the wooden parts were connected cut their way into the wood, and the framing grew looſe in the joints, and, without giving any warning, went to pieces in an inſtant. A ſolid massy simple beam, of sufficient ſtrength, bends, and ſensibly complains (as the carpen­ters expreſs it), before it breaks. In all great engines, therefore, ſuch only are employed, and in ſmaller en­gines he ſometimes uses caſt-iron wheels or pulleys; nay, he frequently uſes no beam or equivalent whatever, but employs the ſteam piſton-rod to drive the machinery to which the engine is applied.

We preſume that our thinking readers will not be diſpleaſed with this rational hiſtory of the progreſs of this engine in the hands of its ingenious and worthy in­ventor. We owe it to the communications of a friend, well acquainted with him, and able to judge of his merits. The public ſee him always aſſociated with the no leſs celebrated mechanic and philoſopher Mr Boulton of Soho near Birmingham (ſee Sono). They have ſhared the royal patent from the beginning ; and the al­liance is equally honourable to both.

The advantages derived from the patent-right ſhow both the ſuperiority of the engine and the liberal minds of the proprietors. They erect the engines at the ex­pence of the employers, or give working drafts of all the parts, with inſtructions, by which any relident en­gineer may execute the work. The employers ſelect the beſt engine of the ordinary kind in the kingdom, compare the quantities of fuel expended by each, and pay to Meſſrs Watt and Boulton one-third of the an­nual ſavings for a certain term of years. By this the patentees are excited to do their utmoſt to make the engine perfect ; and the employer pays in proportion to the advantage he derives from it.

It may not be here improper to ſtate the actual per­formance of ſome of theſe engines, as they have been aſcertained by experiment.

An engine having a cylinder of 31 inches in diame­ter, and making 17 double ſtrokes per minute, performs the work of forty horſes working night and day (for which three relays or 120 horſes muſt be kept), and burns 11,000 pounds of Staffordſhire coal *per* day. A cylinder of 19 inches, making 25 ſtrokes of 4 feet each per minute, performs the work of 12 horſes working conſtantly, and burns 3700 pounds of coals *per* day. A cylinder of 24 inches, making 22 ſtrokes of 5 feet, burns 5 500 pounds of coals, and is equivalent to the conſtant work of 20 horſes. And the patentees think themſelves authorized by experience to ſay in general, that theſe engines will raile more than 20,000 cubic feet of water 24 feet high for every hundred weight of good pit-coal confirmed by them.

In conſequence of the great ſuperiority of Mr Watt’s engines, both with reſpect to economy and manageableneſs, they have become of moſt extenſive uſe ; and in every demand of manufacture on a great ſcale they of­fer us an indefatigable servant, whoſe ſtrength has no bounds. The greateſt mechanical project that ever en­gaged the attention of man was on the point of being executed by this machine. The States of Holland were treating with Messrs Watt and Boulton for draining the Haerlem Meer, and even reducing the Zuyder Zee : and we doubt not but that it will be accompliſhed when­ever that unhappy nation has ſufficiently felt the diffe­rence between liberty and democratic tyranny. Indeed ſuch unlimited powers are afforded by this engine, that the engineer now thinks that no taſk can be propoſed to him which he cannot execute with profit to his employer.

No wonder then that all claſſes of engineers have turned much of their attention to this engine; and see­ing that it has done ſo much, that they try to make it do ſtill more. Numberleſs attempts have been made to improve Mr Watt’s engine ; and it would occupy a vo­lume to give an account of them, whilſt that account would do no more than indulge curioſity. Our engi­neers by profeſſion are in general miſerably deficient in that accurate knowledge of mechanics and of chemiſtry which is neceſſary for underſtanding this machine; and we have not heard of one in this kingdom who can be put on a par with the preſent patentees in this reſpect. Moſt of the attempts of engineers have been made with the humbler view of availing themſelves of Mr Watt’s discoveries, ſo as to conſtruct a ſteam-engine superior to Newcomen’s, and yet of a form ſufficiently different from Watt’s to keep it without the reach of his patent. This they have in general accompliſhed by performing the condenſation in a place which, with a little ſtretch of fancy, not unfrequent in a court of law, maybe called *part of the cylinder.*

The ſucceſs of moſt oſ theſe attempts has interfered ſo little with the intereſt of the patentees, that they have not hindered the erection of many engines which the law would have deemed encroachments. We think it our duty to give our opinion on this ſubject without reserve. Theſe are moſt expensive undertakings, and few employers are able to judge accurately of the me­rits of a project preſented to them by an ingenious ar- till. They may ſee the practicability of the ſcheme, by having a general notion of the expansion and condenſa­tion of ſteam, and they may be miſled by the ingenuity apparent in the conſtruction. The engineer himſelf is frequently the dupe of his own ingenuity; and it is not always diſhoneſty, but frequently ignorance, which makes him prefer his own invention or (as he thinks it) improvement. It is a moſt delicate engine, and requires much knowledge to ſee what does and what does not improve its performance. We have gone into the pre­ceding minute inveſtigation of Mr Watt’s progreſs with the expreſs purpoſe of making our readers fully maſters