the parts revolve in the same time, those nearer to the circumference move with greater velocity than those towards the centre; that the attrition is consequently most rapid at the circumference, and diminishes uniformly towards the centre of the plates; and it necessarily follows, that towards the edges the plates must com­mence an immediate and rapid waste, while the centre remains uninjured. This result is established as matter of experience. It is a circumstance that has caused the failure of many beautiful inventions. It is the rea­son why conical bearings have been universally abandoned for cylindrical ones; and it is the reason why a most beautiful class of inventions has been totally useless to the improvement of the common steam-engine ; wo refer to the revolving valves invented by Oliver Evans and by Murray, hut now universally abandoned, in spite of their simplicity and original cheapness, on account of this inequality in the attrition of flat surfaces revolving round a centre.

The application of the result of this illustrative experiment to the subject in question is abundantly obvious. The rotatory piston is necessarily and inevitably of this nature. Performing a circuit round a centre, different portions of the bearing surfaces subjected to pressure, and necessarily in contact and requiring to be steam tight, revolve at unequal distances from the centre, and therefore with unequal velocities ; hence the circumferential surfaces, under this excessive attrition, wear more rapidly, and become unfit for use long before the central parts have suffered any sensible effect. It is to this difference of velocity and of attrition, arising from the necessary circumstance of motion round a centre, which renders it impossible to keep the rotatory engine in a working condition with advantage, and from which it follows that each day’s work renders the engine less fit for the duty of the succeeding day.

8. The peculiar applicability of the rotatory form of steam-engine to the purposes of steam navigation and land locomotion, has been much insisted on by projectors of rotatory engines. To both these purposes it is, from its form, supposing it to possess no other disadvan­tage, most inapplicable, ln a steam-vessel, it is first of all desirable to have the axis of the paddles as high as pos­sible, and the weight of the engine as low as possible. Now if the engine be placed on an axis, which is the case in this application of the rotatory engine, one of two evils is incurred : either the axis of the wheels must be brought low, which impairs the action of the paddles, or the weight of the engines must be exalted so as to ren­der, the vessel top-heavy, unsteady, or, as it is technically called, “ crank,” and liable to be upset. By the ordinary engine, the axis is elevated to or above the deck, while the weight of the engine remains on the floor, at the bottom of the vessel. Again, to the application of the rotatory steam-engine to the purpose of terrestrial loco motion in propelling carriages on railways or other roads, there are insuperable objections. As the rotatory engine is placed immediately upon the axle of the propelling wheels, there can be no springs between it and the wheels, so that every jolt would derange the machinery. The weight of the engine placed on the axle would in turn reciprocate the evil by knocking the wheels to pieces. In the reciprocating engine these evils are prevented by the detachment of the engine from the axle, and the propagation of power through rods, wheels, or chains, to the propelling wheel or axis ; and if any fault still remain in the principle of locomotive engines, it is the want of perfect detachment in the very respect which the introduction of the rotatory engine would render impossible.

In addition to all these obstacles which stand in the way of rotatory engines, it may be worth while to mention another circumstance of a practical nature which gives great superiority to the common steam-engine; we mean the facilities which it presents, and which the rotatory engine does not possess, for the attachment of the appendages that are indispensable to the functions of a perfect steam engine. The subordinate parts of an engine which belong equally to a rotatory and reciprocatiι∣g steam-engine are, an air-pump, a feedpump, and a well-pump. These merely require to be attached directly to the beam of the common engine, and they are worked without the intervention of auxiliary mechanism, because the motion of the pumps is reciprocating, and the action of the steam is also in the common engine reciprocating; while, on the other hand, in the case of the rotatory steam engine, it would be necessary to convert the revolving movement, by a crank or other more complex mechanism, into the very reciprocating effect which it is intended to supersede.

All these considerations, of a most important and im mediate practical bearing, clearly prove that although, in the most abstract and elementary theoretical view of the subject, there be an apparent equality of effect in the rotatory and the reciprocating steam-engines, yet there are practical objections of an insuperable nature inhe­rent in the very constitution of rotating mechanism, that prevents the possibility of rendering it more perfect.

III. It is lastly our duty to show that the common reciprocating crank steam-engine, not only does not possess the disadvantages attributed to it, hut that it possesses certain very peculiar properties which may not have been hitherto clearly understood and defined, but which nevertheless do adapt it in so admirable a manner to the nature of steam and of solid matter, and to the necessary imperfections of all human mechanism, as to have rendered it triumphant in universal practice over every competitor.

1. It was long imagined that the transmission of power through a *crank,* or *bend,* or *handle* in an axle, was attended in the steam-engine with great loss of effect. In the opinion of such men as Smeaton, the crank was never likely to be used as the means of obtaining rotatory motion from steam; while it is thievery crank that is, in our day, used alone and universally over all other methods, although a great variety of other methods have been successively invented, and finally abandoned for the simple elementary crank. Yet it is not without some show of reason, that objections have been made against the practical working of the crank. We admit that the argument was rather a staggering one, but the difficulty has lately been wholly removed.

The staggering fact, to which we refer, was this : it is given as stated by Dr Penneck of Penzance, Corn wall, in describing a substitute proposed by him for the crank. “Some have considered a wheel as one-third more powerful than the crank, and others that no power is lost by the crank ; but, confining myself to *practical results,* it appears from the report of the duty of steam engines as done in Cornwall, and published by the Messrs Lean, that the performance of the crank-engines bears no proportion to those in which no crank is employed.” He then proceeds to show the advantages of his own engine, in which a ratchet-wheel is moved by an arm, always acting at the extremity of a radius, by which means he hopes to save the loss of power occasioned by the crank. The fact related by Dr Penneck was perfectly accurate. It had happened that the crank steam-engines, working expansively in Cornwall, had never given out an adequate effect. That the fault did not lie in the crank, hut in other parts of the arrangement, is now apparent: it consisted in the want of proper adjustments to admit of favourable action in using the steam expansively. Ar