2. In ease of construction the simple form of reciprocating engines incomparably excels the rotatory. To possess equal powers, the rotatory drum would require to be of much larger diameter than the reciprocating cylinder; and the difficulty of construction increases in a high ratio with the diameter. The diaphragm is also a sliding or revolving piece of mechanism, whose rubbing surfaces require the greatest precision of workman ship. The revolving piston is also a practical problem of the greatest difficulty, and one which has never been satisfactorily solved ; for if it be rectangular with plane surfaces, it is scarcely possible to make its surfaces steam tight ; and if it be a circular and revolving piston, its surface and that of the drum become surfaces of double curvature, and the difficulty is then prodigiously increased. The metallic piston of the common steam-engine is the most perfect and most simple piece of mechanism, which can be made by a very ordinary workman, and which, if imperfectly fitted, will, in the progress of doing its work, become of itself every day more and more perfect. An editor of a well-known practical journal, although a believer in the rotatory engine, speaking of one of its simplest forms is compelled to admit, “that there being no mode described of making the parts of the engine steam tight by packing, they must he all made so by accurate workmanship and grinding, the expense of which, in the outset and in repairs, would certainly be too considerable to allow it to come into competition with other steam engines of a more common and practicable construction.”

His admission is equally applicable and fatal to all the forms of the engine.

3. The cheapness and first cost of the engine, will result from the two former points of inferiority, and will be further shown, from those which follow, to be greatly and necessarily in favour of the common engine. Not only are the parts, from their nature, more easy of construction, but the extent of polished surface will be shown to be much greater in the rotatory, than in the reciprocating engine.

4. The quantity of surface exposed to friction is greater in **the** rotatory engine. Let it be recollected that, in the rotatory engine, the piston describes the semi circumference of the circle, while the piston of the reciprocating engine is describing the diameter of it. Let it also be recollected, that the reciprocating piston passes back through the returning stroke, over the very same surface through which it formerly descended, while the rotatory piston necessarily revolves over a new sur face, forming the other semi-circumference of its orbit. Let it also be recollected, that the form of the reciprocating cylinder may be so proportioned, that it may have a minimum of surface, while the length of the circuit of the rotatory piston prevents the possibility of giving it a proportion to the radius of the piston by which this object would be attained ; for it would be equivalent to making a circle whose diameter should be equal to its circumference, which is impossible. It is impossible, therefore, that the friction can ever be as small in the rotatory as in the reciprocating engine.

5. Compactness.—It follows in like manner, that the bulk and space occupied by the rotatory engine must be greater than in the reciprocating engine ; for in the one case the piston must describe the circumference of a circle, whose diameter is greater than twice the radius of the piston, and in the other ease it is only necessary that the piston pass through the diameter of it.

6. In precision and uniformity of working, its inferiority will be rendered manifest under head III., when the peculiarities of the crank are expIained

7. In durability and economy in the wear and tear of ordinary working, the rotatory must, from certain elements

in its constitution, be necessarily far inferior to the common engine. It contains in the very nature of its action, elements of speedy destruction and expensive and frequent repairs, so that it can never become an economical engine. Before proceeding, however, to demonstrate the cause of this inferiority, the fact of this inferiority, as existing in all previous engines, we shall adduce from the unwilling evidence of a friend to rotatory engines. Speaking of Mr Halliday's engine, he says that, “ the extreme accuracy and nice fitting of parts necessary for it, will make it very difficult to execute and very easily deranged. Rotatory steam-engines possess considerable advantages both as to speed and economy of power, and would therefore be preferable if they could be made to work as well for a continuance, and be as easily kept in good order as common alternating steam-engines ; but from their being so very seldom used, we apprehend that this is very far from being the case with any of them at pre sent, and that the production of a rotatory steam-engine possessed of these necessary qualities, is still an object of research.” So far the Editor of the Repertory of Arts, in testimony that the rotatory steam-engine *never has* been made to work durably and economically; we now *go* on to show that it *never can.*

It is essential to the durability of a machine that its parts should wear uniformly, and that, if possible, the mere process of wearing should make them fit each other more closely. This is preeminently true of the piston and cylinder of a common reciprocating steam engine. Its piston, cylinder, and valves fit more closely as they wear, and are worn with perfect uniformity, so as not to require repair until, by long working, the whole thickness of matter in action shall at length have been consumed. This is the perfection of mechanism, and is admirably exemplified in the metallic piston of a steam engine, which, working night and day. will require no re pair of any kind until, after a long period of years, the whole strength of the metallic rings shall have been consumed.

ln the very nature of the rotatory piston, this uniformity of friction, this increasing adaptation of surfaces, this permanence of the best working condition is impos­sible. A common reciprocating steam-engine attains its best working condition after it has wrought for some years; but a rotatory steam-engine, if it have been brought by care and precision in workmanship to a state of high finish and perfect accuracy, so as to work well for a day, commences from that moment a rapid course of deterioration, every succeeding degree of which accelerates the progress of decay ; a decay which can only be retarded by continual, laborious, and expensive repairs. The following considerations may render obvious the nature of the elements of self-deterioration in the constitution of a rotatory steam-engine.

Suppose two perfectly flat plates of polished metal perfectly round to be laid one upon the other, so as exactly to coincide at every point ; let the undermost rest upon a table, and let the uppermost be so made as to turn round on an axis while in contact with the other, and let a rapid motion be communicated to the upper most; let us consider what the result of the attrition of one of these upon the other will be : will they wear equally, so as to remain in a state of mutual adapta tion, or will they not? Experience furnishes us with a reply that exactly quadrates with a reasonable expectation : they will not wear equally, they will not retain their form, they will not remain flat ; they will wear away most rapidly at the circumference, and wear open there while they are quite close at the centre. Let it be considered that the outer edge performs a larger circuit than a part nearer to the centre; that, therefore, since all