wire, about the fortieth of an inch in diameter, is soldered to one of the thick wires, about a foot from one of its ex­tremities, and is wrapped round the horse-shoe bar in the same direction as the thick wire, and in one continuous he­lix. When the opposite ends of the seven thick wires are connected with the opposite poles of a voltaic battery, the horse-shoe bar is converted into a magnet of extraordinary power, and when the battery communication is broken, an electric current of singular intensity is established in the long coil of small wire. The armature or keeper of Mr Callan’s magnet was a horse-shoe bar of iron 20 inches long, two and a-half in diameter, and weighing 28 lbs. Its poles were seven inches apart, and the apex of the arch seven inches high. Such was the power of the magnet that it was found impossible to separate the keeper from it by any force acting in a direction perpendicular to the touching surfaces. The calorimotor, consisting of a single pair of plates, with 18 square feet of copper, and 16 of zinc, was found by Mr Noad more effective in exciting the magnetism than a Wollaston battery of 100 double pairs highly excited. When the connexion was broken between the battery and the charcoal points fixed to the thick wires, the succession of sparks formed a continued blaze of brilliant light, and when a succession of sparks was sent rapidly through a large fowl, they produced instant death.

The idea of applying the powerful agency thus deve­loped in a bar of iron, as a mechanical power, naturally suggested itself; but there is reason to believe that Mr Thomas Davenport of Brandon, in the county of Rutland, and state of Vermont, was the first person who thought of applying it in producing rotatory motion. This uneducat­ed individual, by trade a blacksmith, having, in 1833, acci­dentally seen one of Professor Henry’s electro-magnets, purchased it with the idea of employing it as a mechanical power. In July 1834, he is said to have constructed a vol­taic engine ; and on the 16th March 1837, he took to New­haven two machines ; one a *rotatory machine, composed of revolving electro-magnets, with fixed, permanent magnets ;* and the other, a *rotatory machine, composed entirely of elec­tro-magnets in its fixed and revolving members,* which being wholly made of soft iron, may be magnetised in an instant by a very small battery.@@1 Professor Henry,@@t however, had pre­viously, and so early as 1831, produced a reciprocating mo­tion by magnetic attraction and repulsion, aided by electro­magnetic action ; and as the contrivance seems to have been overlooked in this country, we shall lay before our readers his own drawing and description of it.

In Fig. 64, AB is an electro-magnet of soft iron, about

'seven inches long, and moveable on an axis at the centre

S. Its two extremities, when placed in a horizontal line, are about one inch from the north poles of the upright magnets C and D. G and F are two large tumblers con­taining dilute acid, in each of which is immersed a plate of zinc, surrounded with copper. *l, m, s, t,* are four brass thimbles soldered to the zinc and copper of the batteries, and filled with mercury.

“ The electro-magnet AB is wound with three strands of copper bell wire, each about twenty-five feet long. The similar ends of these are twisted together, so as to form two stiff wires, which project beyond the extremity B, and dip into the thimbles *s, t.*

"To the wires *q, r,* two other wires are soldered, so as to project in an opposite direction, and dip into the thimbles *l, m.* The wires of the electro-magnet have thus, as it were, four projecting ends ; and by inspecting the figure it will be seen that the extremity *m,* which dips into the cup at­tached to the copper of the battery in G, corresponds to the extremity *r* connecting with the zinc F.

“ When the batteries are in action, if the end B is de­pressed until *q r* dips into the cups *s*, *t,* AB instantly be­comes a powerful magnet, having its north pole at B. This of course is repelled by the north pole D, while at the same time it is attracted by C. The position is conse­quently changed, and *o p* comes in contact with the mer­cury in *l, m.* As soon as the communication is formed, the poles are reversed, and the [>osition again changed. If the tumblers be filled with strong dilute acid, the motion is at first very rapid and powerful, but it soon almost en­tirely ceases. By partially filling the tumblers with weak acid, and occasionally adding a small quantity of fresh acid, a uniform motion, at the rate of seventy-five vibra­tions in a minute, has been kept up for more than an hour. With a large battery, and very weak acid, the motion might be continued for an indefinite length of time.

“ The motion here described is entirely distinct from that produced by the electro-magnetic combination of wires and magnets. It results directly from the mechanical ac­tion of ordinary magnetism—galvanism being only intro­duced for the purpose of changing the poles.”

Professor Green, to whom Professor Henry first exhib­ited this machine in motion, recommended the substitution of electro-magnets for the two vertical ones C, D. Though Professor Henry described this apparatus as a toy, yet he distinctly states, that in the progress of discovery, the same principle, or some modification of it on a more extended scale, might hereafter be applied to some useful purpose.

These contrivances have been followed by several others of great ingenuity. The Rev. J. W. Macgauley exhibited a working model of an electro-magnetic machine, to the British Association at Dublin in 1835 ; and in the sixth report of the Association he mentions his having “in his possession a machine of not inconsiderable power.” Mr Sturgeon of Woolwich mentions that he had a galvanic ma­chine in use on his premises, for pumping water, and for other mechanical purposes.@@3 Mr Jacobi has some time ago employed electro-magnetic machinery for impelling a boat on the Neva at St Petersburg ; and Mr Davidson of Aber­deen has made a similar application to a turning lathe.

A series of beautiful instruments, of great practical value, have been invented for increasing minute voltaic effects, by electro-magnetic action. The first of these was constructed by Professor Schweigger of Halle, immediately alter the discovery of electro-magnetism. It is exhibited in fig. 65 where a magnetic needle SN, is placed or sus­pended within several bendings of the unit­ing wires ABCDE. Now, as each of the branches of this wire acts upon one of the poles of the needle in the same direction, the effect will be *quadrupled;* and hence the direction of the needle becomes a means of mea­suring any minute voltaic effects produced in the uniting

@@@\* Silliman's American Journal of Science, April 1837, vol. xxxii∙ No. 65, p. 217.

@@@’ Ibid July 1831, vol. xx. p. 340.

@@@’ Report on, vol. v. p. 24.