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RAIL-ROAD NEWS.

Western Railroads.

The Economist (Cannelton, Ind.) has an excellent article on Western improvements and Railroads. The following table will show that, in the course of three years at farthest, 8,399 miles of railroad will be in operation in the West and some of the new States.

	No. of roads.	Miles in operation.	Miles constr'g.	Cost of constructing.
Texas,	1	—	72	
Tennessee,	5	30	602	$600,000
Kentucky,	7	77	518	1,500,000
Ohio,	30	690	1697	12,768,793
Michigan,	4	432	33	8,460,340
Indiana,	20	279	1142	5,100,000
Illinois,	16	119	1772	2,960,000
Missouri,	2	—	500	——
Iowa,	1	—	180	——
Wisconsin,	1	20	236	4,000,000
	87	1647	6752	$35,389,133

The Southern and Western States will undoubtedly profit more by railroads than the Eastern States, owing to their greater extent of territory, and, as a general thing, the extensive plains through which they pass, which require but few embankments or cuttings. We hope our Southern and Western States are also pushing along plank roads: these roads are essential to our farmers, as auxiliaries to the railroads.

Coal-Burning Locomotives.

Mr. Dimpfel's Anthracite Coal-Burning Locomotive, which had been in active use for one year on the Reading Railroad has been bought by the Utica and Schenectady Railroad, in this State. It is stated that it has fully overcome all obstacles in the way of burning anthracite coal, and has greatly reduced the cost in fuel. This engine we described in our fifth volume, page 405. A year's steady use seems not to have affected the tubes of the boiler. The attention of steamship owners may profitably, we think, be directed to the improvement of Mr. Dimpfel, and that of Mr. Mulholland. If these improvements only reduce the cost of fuel 7 per cent., the saving is very great for our Atla tic steamers—the longer the voyages the greater the advantages of economy in fuel.

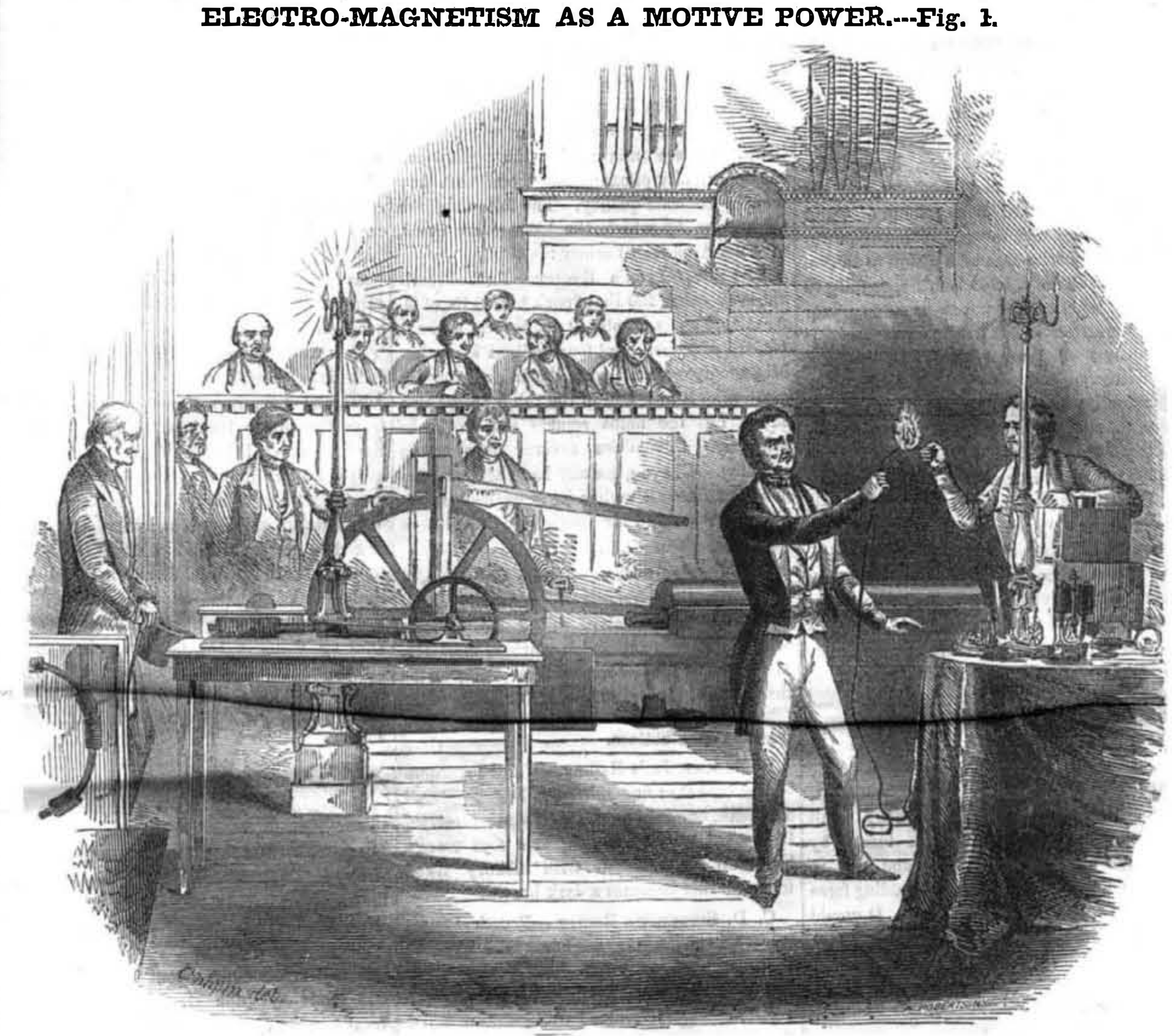
Vermont Central Railroad.

This road is being built from Bennington to Rutland, a distance of 55 miles, the grading and bridging are to be finished by the first of next December. The rails are being laid from Rutland, south, and about 17 miles are now ready for the cars. A branch from Eagle Bridge, N. Y., is building to intersect at North Bennington, Vt. This will make a direct line of railway from New York City to Rouse's Point and the Canadas.

Accident to the Africa.

The Canada and Baltic arrived here last Sunday morning, from Liverpool. The Canada came out in place of the Africa, which ran ashore in a fog near the Belfast Loch, in Ireland. The Africa returned to Liverpool not greatly damaged.

ELECTRO-MAGNETISM AS A MOTIVE POWER.---Fig. 1.



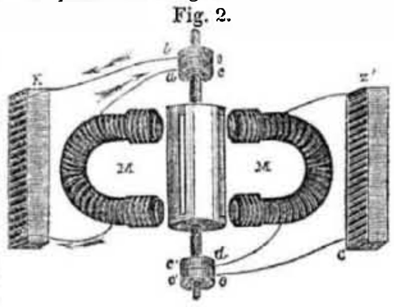
As noticed by us last week, we proceed to give the substance of Dr. Page's Lecture on his Electro Magnetic Engine, and also give a succint history of the applications of this power. We here present Prof. Page, as he appeared in the Tabernacle explaining his engine, and going over his experiments. His assistant is A. Davis, an electric engineer, and the brother of D. Davis, of Boston, so well known for his electric instruments. A number of lectures have been delivered in both the Tabernacle and Society Library, and the audiences have been of the most intellectual and scientific quality. They have given great satisfaction, both on account of their nature and the unassuming manner of the lecturer.

When he (Prof. Page) took up the subject of applying electro magnetism as a motive power, he found that all which had been done, was based upon the attractive and repulsive properties of electro magnets. An electro magnet consists, in an insulated wire, coiled round a bar of soft iron, with its ends open, and connected with a galvanic battery. When the circuit of the battery—the wire that connects the two last plates of it together, is closed, the end of the soft iron bar, which before was powerless, acquires a mysterious power, and will attract a mass of iron with great force to it. This will not produce a motive power, it is static force, but when the circuit of wire is broken, the virtue of the magnet ceases, and the attracted metal falls.

The first engine for producing motive power by electro-magnetism, was invented by Prof. Henry, now of the Smithsonian Institute. In 1833 with a battery contained in one cubic foot of space, sustained a weight of more than 3,000 pounds; and he constructed a machine to move machinery, which is described in Vol. 20, Silliman's Journal. The electro m gnet has two poles, the positive and negative, and the two similar poles of two magnets repel one another. Prof. Page found that all the old electro magnetic engines were constructed on the principles of attraction and repulsion to produce motion. It is known that Davenport in our own country, Jacobi in Russia, and Davidson in Scotland made, some years ago, electro magnetic engines of considerable size; Jacobi propelled a boat on the Neva, in 1839; Davenport and Ransom Cook had quite respectable engines working in this city in 1840, and Davidson ran a locomotive, in 1842 on a railroad near the city of Glasgow, Scotland.

The engine of Jacobi was about two horse-power, that of Davidson propelled the locomotive, weighing five tons, at the rate of four miles per hour. It was equivalent to a little over one horse power, but Davidson used the attractive power alone, of the electro magnet, as is represented in fig. 2.

Fig. 2.



The axle we will suppose to be one of the locomotives, with the wheels removed, and the magnets, M M, we will suppose to be firmly fixed on the truck of the engine. We will suppose the batteries to be fixed at each end of the truck, and now, if we had two axles and four wheels, we should have the locomotive, but figure 2 will explain the principle of action much better. On the axle is a cylinder of wood, on which re secured three masses of iron at equal distances apart, and running the whole length. When one electro magnet is charged it will attract one mass of metal to it, and thus make the axle move on its axis partly round, then this magnet has its circuit broken, and the opposite magnet charged, which attracts the opposite mass of iron on the cylinder, and thus rotary motion is given to the axle and the wheels are revolved.

Near each end of the axle are two small cylinders, each one of which has the half of its rim next the large cylinder, covered with metal; the outer halves, o o', are partly covered with metal, and partly with ivory; the dark spaces on o a' represent the conducting parts of metal; the white are the ivory.

One end of the coil around magnet, M, is connected with Z, or pole of one battery, the other end of the wire, *a*, rests on *c*, the metal rim of one small cylinder. The wire, *b*, from the other pole, K, rests on the other metal part, *o*, and thus the electric circuit is formed. The arrows point out the direction of the current, which, when the circuit is formed, renders the magnet, M, powerfully attractive, but when the circuit is broken, it has no attractive power. On the opposite small cylinder, the wire, *e*, rests on a non-conductor (the ivory) therefore the electricity cannot pass from *d* to *e*, the circuit therefore is broken, and while M is a magnet M is non-magnetic, but as the cylinder revolves, it will be noticed the ivory and the metal pieces on the small cylinders, alternately break and close the circuits, and thus alternately attract the cylinder to give it a continuous rotary motion. Davidson used [illegible] pairs of 13 inch plates, the negative being iron, the positive ones amalgamated zinc. The result of power was very frail for such an amount of battery surface. We have heard no more about Davidson since.

Prof. Jacobi got out of 20 square feet of platina battery surface, one horse p wer.

(Continued on page 68.)

Electro-Magnetism as a Motive Power.

[Continued from First Page.]

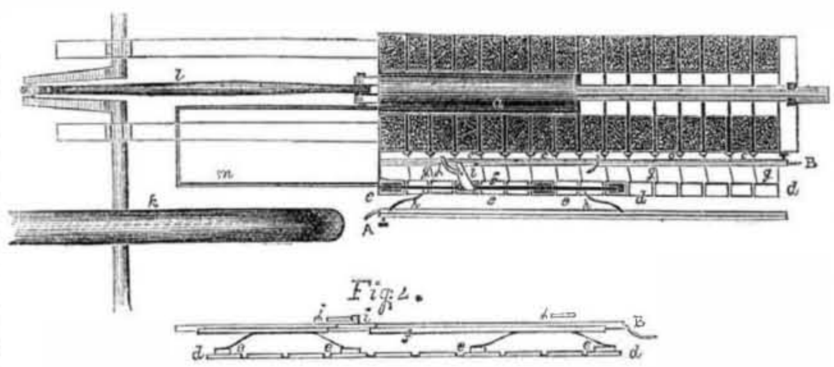
Many have believed, and now believe, that the principle of attraction and repulsion is better than the attraction alone. Davenport, of Vermont, used a walking beam engine with metal pistons moving in hollow magnetic coils, each coil forming a whole hollow cylinder.

Prof. Page's engine differs from all these in principle, in arrangement and action. He found that the magnet required time to receive the magnetism of the coil, or in the words of Snow Harris "to create a magnetic atmosphere," and it also required time when the circuit was broken, for the magnet to part with its induced magnetism; the induced magnetism or secondary current of the magnet acted also in the very opposite direction to the one required.

To remedy this he came to the conclusion that it was necessary to make the current of the magnet (the secondary current) act always in the same direction with the object to be moved, at the same time it was necessary that the magnet should always be magnetic. This was for the purpose of gaining in the element of time, as the magnet could not at once be deprived of its counter-force. He therefore adopted the principle of *hollow electro-magnetic coils*, and a number of them as represented in fig. 2. The principle by which this engine is operated is electro-magnetic attraction by the intermittent charging of a series of hollow magnets acting continuously on a piston magnet moving inside of them, in the direct line of motion, whether that line of motion be horizontal, vertical, or circular [rotary]. In figure 1, a rotary cylinder is represented on the stage, and as it was the first, it seems still to be the favorite with Mr. Page, but we have chosen this horizontal section of it for explanation, as we believe it is the best, and has mechanical advantages superior to the other, and also a longitudinal vertical section, fig. 4, of the circuit changer, which performs the same office for this engine, that a slide valve does for a steam engine.

The dark space are a series of hollow magnets formed of square copper wire wrapped round a mandril. There are about 1,500 yards of wire in each coil. These coils are covered with a non-conducting substance. When the mandril is withdrawn, and these coils fixed on a frame, they form a cylinder made up of sections, (coils). They are all connected together metallicaly, but are so arranged and connected with the cut-off or slide, that but three magnets (hollow coils) are changed at once, and one coil is being continually cut off behind, and the current being continually thrown on to the coil before in the direction in which the piston is moving. This is the peculiar feature of this engine, it is a continual electro-magnetic draught in the secondary current direction of the iron magnet; this magnet is a round mass of iron, *a*, placed in the very centre of the coils. When the coils are charged, this bar of iron moves in their inside like Mahomet's fabled coffin touching nothing. In fig. 1 is number of vertical coils, and in their inside is a huge mass of iron of 520 lbs. weight; when these coils are charged by being connected to the battery, the huge bar mysteriously rises in the very centre of the coils, when the battery circuit is broken, the bar falls. A number of persons were placed on the platform on top of this bar, and they were elevated by that mysterious agency —which cleaves the oak tree into fragments, and no less powerful here, because unseen. But let us describe the engine: the dark spaces are the hollow coils, they are secured horizontally on a suitable frame; *a* is the piston or bar of iron, which is free to move in the inside of the coils, and which is attracted with great force, backwards and forwards in the inside of the hollow coils; *l* is a piston rod secured to a double crank, which gives motion to a shaft, on which is a fly-wheel, K. This shaft by having pulleys on it, can, by bands, give motion to all kinds of machinery. In fig. 1 a circular saw is displayed, this was made to saw timber in the presence of the audience. Attached to one side of the piston rod is an arm, *m*, which works the cut off. The battery is not shown, but A is the positive wire, and B is the negative wire coming from the opposite ends of the battery. Thumb screws are represented to screw the battery wire to the rods of copper, one running along one side the whole length of the coils, and the other close to the coils on a narrow platform on the engine frame; *d d* are small blocks connected with the hollow coils by the wires, *g g*, as represented, and form the connecting points of the circuit, and perform a similar office to the ports of a steam engine; *f* is the slide moved by the arm, *m*. It has two thin strips of copper on it, separated a short distance at the middle part. Each strip has two metal spring plates, *e e*, on it, always in contact with some of the copper blocks, *d d*, as shown in figure 4. Only two of these plates, *e e*, are in connection with the battery at once, the ones for example at the left hand for the motion of *a* to the left, and the other set for its motion to the right. The wires, A B, the springs, *h h*, the slides, *e e*, and the wires, *g g*, form the electric circuit rendering the coils magnetic, therefore, as the slides move backwards and forwards, the circuit is formed alternately from coil to coil, cutting off the current behind and throwing it on ahead, as spoken of before; *i* is the stroke changer, that

Figure 3.



is, it reverses the stroke of the engine, by throwing the current from one half of the coils to the other half. This is done by two dogs or projections, *j j*, fixed on the side of the frame. The changer, *i*, is fixed on a centre-pin, and when it strikes one cam, *j*, it brings one set of slides, *e e*, to form the circuit, and when it strikes the other cam, *j*, the changer, *i*, turns on its pin and comes in contact with the strip of copper which is attached to the other slides, *e e*; there is therefore always three of the coils charged at once, as will be observed in fig. 4, but whenever a full stroke is made, the changer, *i*, at once diverts the current from one half of the coils to the other, acting upon the opposite end of A, by the three coils near the middle being first charged, and so on one after the other as the piston moves along. A stroke of any length can thus be given to the engine, a thing never done before. The common electro-magnet, say one that will attract 1,000 lbs. at one inch distant will only attract 32 lbs. if placed at two inches distant, it loses power, to use a familiar phrase, according to the square of the distance; in this engine, the piston always moves in the magnetic equator, which is the centre of the hollow coils.

The accompanying engravings represent a very ingenious Electro-Magnetic Engine, invented by Soren Hjorth, of London, and patented April 1849. The inventor proposed to apply it to propel ships and rail cars.

Fig. 5 represents the elevation of an engine made on this principle; and fig. 6 a section of the same engine. A A is a horse-shoe-formed hollow magnet, conical on the inside, coiled with copper or other wires, and suspended in such a way that it oscillates on the centre, B, with suitable bearings and plummer blocks, as shown in the figure. In the interior of this magnet is fixed a number of conical rods of different lengths. B B is another horse-shoe-formed magnet, conical on the outside, with apertures corresponding to the conical rods in the magnet, A A, and likewise coiled with wire. This magnet moves on the guide-rods, D D, which are connected together at the top

Figure 5.

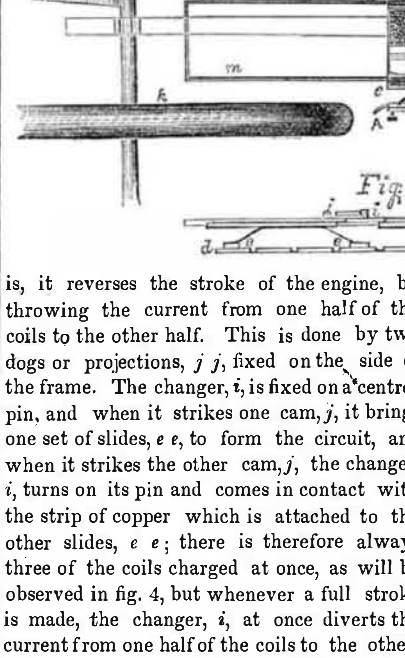
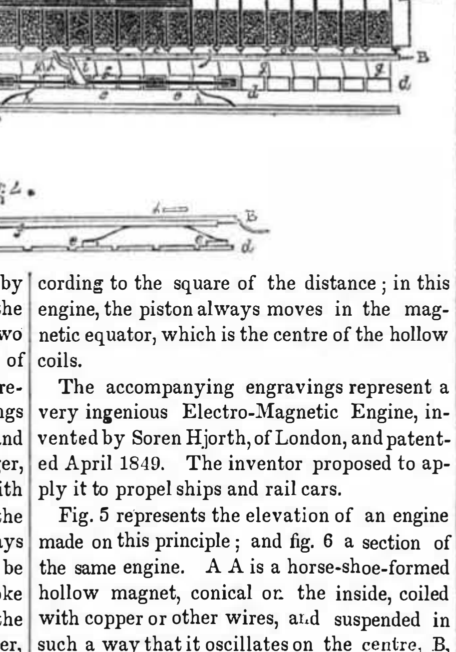


Figure 6.



by means of the cross-head, E, and fastened at the bottom of the magnet, A A. The guide-rods may also be fixed to the magnet, C C, and guided by rollers. A connecting rod is attached to the magnet, C C, in the centre, driving a fly-wheel shaft by cranks in the usual way. F is the commutator to change the electric current as required, which is similar in its mode of working to the slide valve of a steam engine, and moved in a similar way by an eccentric and eccentric-rod. The action of the engine may be reversed by the use of a supplemental eccentric. The governor serves to regulate the proper supply of the electric current to the commutator, O, as afterwards described.

The current, after being regulated by the governor, is introduced through the commutator into the helix of wires coiled round the magnet, A A, and thence through the conducting wires to the helix or coil of wires surrounding the magnets, C C, and thence through the conducting wires to the battery, or by the reverse course, as may be found convenient. As soon as the electric fluid from the batteries passes round the magnets, they exercise their power by a mutual attraction, not only in the ordinary way, but in consequence of the magnets being so shaped that the inside part of the outer magnet, as well as the outside part of the inner magnet, forms angles with the direction of motion of the moving or working magnet; and, at the same time, rods of different lengths presenting themselves at the poles of the respective magnets, the attractive power is sustained over the whole stroke by successive points and successive parts of the surfaces being brought to act upon one another during the whole stroke. When the stroke in this manner has been made by one set of magnets, the current is changed, and the other set of magnets are made effective by the current passing round them in the same manner as before described. In order to prevent the current from being broken, and also to check the momentum of the magnets, the slide in the commutator, F, is made so long that it does not leave the conducting surface which communicates with one set of magnets, until it has reached the other, communicating with the other set of magnets.

By the arrangements above described, a reciprocating motion is obtained similar to that of the common oscillating steam engines, and it will be obvious that a motion may be obtained similar to that obtained by any of the various forms of steam engines by suitable adaptations of beams, rods, cranks, &c. Thus it may be carried out as a single or a double acting engine, as an ordinary beam engine, or as a direct action engine, according as it may be required for stationary, locomotive, or marine purposes; and in all cases its form may be varied according to the circumstances of the case.

It will be observed that the difference between Hjorth's—the most ingenious magnetic engine ever produced in Europe, and that of Prof. Page, is very great. The piston, *a*, of Page's engine is a movable magnetised bar, and in every sense of the word is like the piston of a steam engine, only there is no packing or cylinder covers required. The size of battery used was 40 ten inch plates, "Grove's battery." The power had been tested by a friction brake—the lever shown in fig. 1—and gave 8 horse power. This brake is a lever fastened to the periphery of the fly-wheel, *k*, and is eleven feet long, the fly-wheel having 13 feet circumferential surface. We did not see it tested to this power. We, among many others, believe that friction brakes are not always true tests of horse power, we prefer the elevating of a weight according to the formula of Watt, for we have seen the friction brakes give unsatisfactory results. The power of this engine, to the size of the battery, is very great, and it is asserted that by increasing the battery, the power is increased in an equal, if not greater ratio.

This is quite different from other magnetic engines, which are stated to have always produced results greatly disproportionate with large batteries. The free length of stroke which can be given to this engine, is a new and important feature, and the breaking and closing of the circuit at a distance from the magnetic pole, or bar, *a*, is another important feature, for very feeble sparks and noise are thereby produced by the engine. In figure 1, Prof. Page and Mr. Davis are represented as breaking the circuit of the battery, and producing a flame, but the flash, should be very feeble in comparison with the one represented. When the wires are placed on the end of the rounded bar, near which Mr. Davis is resting his left arm, and there drawn apart, it produces a huge flame, and a report like a pistol. There is a continuous series of flashes fleeting along, as the springs, *e e*, pass from one plate, *d*, to the other. It must not be forgotten that the changer, *i*, is continually in contact with the negative pole on the inside, and is only shifted metallically on the positive side, to throw the current from one end of the piston to the other, to give the reverse stroke. No hot wells nor pumps are employed, and the question rises, will this engine ever supersede the steam engine. This engine, unlike others, we now say, is *practical*—positive evidence having been adduced to prove this; the question is one of economy between this and the steam engine, which is also a very simple machine. We have not the means of judging of the comparative expense of this engine and the steam engine, nor of comparing the practical working of the two, but it is well known what our opinion is with respect to the steam engine—it is as yet the first of motors by a long way, and will yet be greatly improved. But a great stride in advance has been made by Prof. Page; he has produced the most perfect Electro Magnetic Engine ever built, and future improvements, if they can be made (and who doubts it), may yet bring it to be the compact motor, so desirable for aerial navigation, and without which no such art can be rendered practicable, and no fears of explosions.