For the Scientific American.

Poisonous Metals.—Liquid Tests of Arsenic.

In all medical examinations connected with legal inquiries a preliminary experiment is performed with distilled water, and hydrochloric acid is used to resolve the arsenic, after which the slip of copper foil is introduced. It is a fact, says Noad, of especial importance in a medico legal point of view that a person may have died from the effects of poison and yet not a trace of it be discovered in the stomach or its contents. In such cases where suspicion exists, some of the solid parts of the body, such as the liver and the blood, will have to be examined, and the best manner of preparing these substances for test is described by Fresenius, which is to digest the organic substances in a water bath with an equal weight of concentrated hydrochloric acid and as much water as will give the whole a thin consistence. Chlorate of potassa is then added, in portions of about half a drachm at intervals of about five minutes until the contents have assumed a bright yellow color, perfectly mixed, and of a thin liquid appearance. When this is attained about 2 drachms more of the chlorate of potassa is then added to the mixture and the basin is then removed from the water bath. When cool, it is filtered and the residue washed. This filtrate is then concentrated to about a pint and a quantity of sulphurous acid added to reduce the arsenic acid to arsenious acid to make it more easily precipitated by sulphuretted hydrogen. The excess of sulphurous acid is then driven off by heat, and the fluid exposed to a slow stream of sulphuretted hydrogen gas for about 12 hours. The sulphuret of arsenic thus obtained is washed and treated with fuming nitric acid evaporated to dryness, moistened with pure sulphuric acid and then gently heated, first on the water bath and afterwards at a higher temperature of about 300 degrees, until the mass begins to crumble. The residue is then treated with boiling water, then filtered, and the clear fluid after being again acidified with hydrochloric acid is again precipitated with sulphuretted hydrogen gas.—The pure sulphuret of arsenic thus obtained is mixed with the carbonate of soda and cyanide of potassium, then mixed with charcoal dust and reduced in a tube, when the metal volatizes and condenses on the cool part of the tube, as has been described in a former article.

All nitrates and various salts of mercury and other metals render the separation of arsenic from a solution, by a copper foil being boiled in said solution, to precipitate the arsenic on the copper—very difficult, next to impossible, and in such cases, the liquid test of Fresinius already described, is the best. It would be well for those who desire a more elaborate treatise to consult the late works of Fresenius and Dr. Turner and M. Rose.

Many may think it morally impossible that a person can be poisoned by arsenic, and the stomach exhibit no traces of the poison at the same time. Yet it is a fact. About 16 years ago there was a very fashionable color called *sage green* employed in the manufacture of cotton ginghams. It was principally dyed in the cities of Manchester and Glasgow in Britain, and dyed in the yarn. Arsenious acid dissolved by boiling in water, and the sulphate of copper, precipitated by caustic lye, were the ingredients employed in dyeing this beautiful green color. The precipitate of these ingredients absorbed by the cotton yarn was so fine and powdery and adhered to the fibres so tenaciously, that it was next to impossible to remove the dust by washing in water. Owing to this when the *winders* (mostly old women) were winding the yarn on pirns or bobbins, a great deal of this fine dust was thrown off in the operation and many fell a sacrifice ignorantly to this poison in toiling for their daily bread. A number of weavers too, had their health seriously injured while weaving the yarn, and it was noticed that no bird, such as canaries, could live in the houses where the yarn was wound from the skeins into bobbins. In every shape it is a dangerous poison, and yet as a pure metal it is said to be harmless and only virulent as an oxide. It was asserted by Orfila that arsenic sometimes existed naturally in the human body, but this was a grave error,—it may exist naturally in the poison of snakes and the effluvia of mad animals, but certainly in no other manner in animated nature that we can conjecture.

To Wash Iron with Gold.

It is said that it sulphuric ether is mixed with the nitro muriate of gold, that the gold will combine with the ether, and become seperate from the acid. By taking a camel hair pencil and writing with the ether gold solution on bright steel and then plunging it in cold water, the steel will be coated, where wrote upon, with gold. The steel is afterwards to be heated to as high a degree as possible without changing the color, when the gold may be burnished.

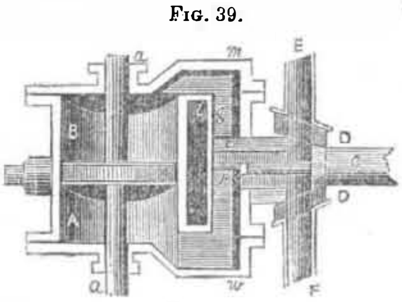
History of the Rotary Engine.

Prepared expressly for the Scientific American.

WITTY'S ROTARY ENGINE.

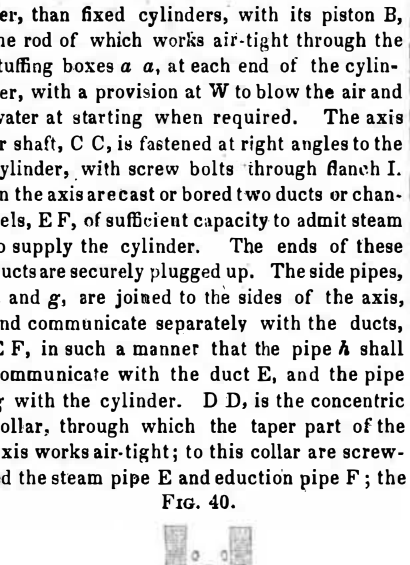
This is a rotative engine invented and patented in 1810 by Mr R. Witty of Hull, England and described by Galloway and is a substitute merely for the crank—the great object of all rotary engines.

FIG. 39.



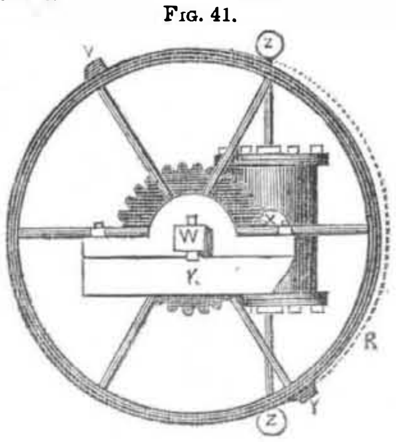
A, Fig. 39, is the cylinder, shorter and wider, than fixed cylinders, with its piston B, the rod of which works air-tight through the stuffing boxes *a a*, at each end of the cylinder, with a provision at W to blow the air and water at starting when required. The axis or shaft, C C, is fastened at right angles to the cylinder, with screw bolts through flanch I. In the axis are cast or bored two ducts or channels, E F, of sufficient capacity to admit steam to supply the cylinder. The ends of these ducts are securely plugged up. The side pipes, *h* and *g*, are joined to the sides of the axis, and communicate separately with the ducts, E F, in such a manner that the pipe *h* shall communicate with the duct E, and the pipe *g* with the cylinder. D D, is the concentric collar, through which the taper part of the axis works air-tight; to this collar are screwed the steam pipe E and eduction pipe F; the

FIG. 40.



former leading from the boiler, and the latter to the condenser and exhausting pump. The two holes in the collar, where the two pipes are joined, are made in the form of a parallelogram, so that when the cylinder, side pipes, and shaft, turn round through the collar D D the communications betwixt the boiler and cylinder, and the cylinder and condenser, will be open alternately during half the revolution, and each side of the piston will be open, or exposed alternately to the steam and the condenser.

FIG. 41.



Fig, 40 represents what is called the cardioid motion, attached to the engine. It consists of a parallelogram, frame, or trammel groove, joined to the piston rod by the two triangles M M, M M. The two friction wheels, N N, are hung betwixt the ends of these triangles, and the piston-rod and rim betwixt the side joints O O O O, cast or screwed upon the covers of the cylinder. At a distance of half the stroke of the piston from the centre of the cylinder shaft is fixed a strong stud or pin, having a strong knee crank, at right angles from it, to support the gudgeon end of the cylinder shaft at S. On the round part of this stud runs a wheel P, filling the trammel groove, and the square is driven tight into another piece of cast-iron, and keyed fast, and this is bolted down to a beam of wood, as at K, Fig 41. When the steam is admitted under the piston the trammel groove moves with the piston rod, and is turned from a rectilinear to a rotary direction by the stud P, resisting on one side of the trammel, and causes the cylinder to revolve towards the stud, and as it revolves the groove comes perpendicular, or at right angles to the situation in which it is seen in the figure. the cylinder lays horizontal, the piston is at the extremity of its stroke, and the alternations of the steam take place at that instant in the axis. In this position the engine may be said to be passing centres, similar to that of a beam engine, when passing the vertical position of the crank; and thus a continued revolving of the cylinder is effected, while its piston describes a circle, the diameter of which is half the length of the stroke.

Fig. 41 is a contrivance for applying the force of the piston upon a wheel R, or crank, which revolves upon a separate axis at W, placed half the length of the stroke of the piston from the centre of the cylinder shaft X, which is supported by a knee from or through the centre of the wheel, similar to the contrivance for supporting the gudgeon of the cylinder, Fig. 40. The diameter of the wheel is made equal to the length of the piston rod Z; and has its rim made to incline or project, in order that the piston rod may lay hold of it alternately at the stops Y Y.

Chemical Affinity—Definite Proportions.

A remarkable fact relative to chemical affinity is, that the quantity of any substance required to form a particular compound is always the same; and so long as a body retains its general characteristics, it will always consist of the same elements, united together in the same proportions. For instance sulphuric acid (oil of vitriol) is always composed of 16 parts, by weight, of sulphur, and 24 of oxygen. No other substances can form sulphuric acid, nor can its own elements produce it, if combined in any other proportions than those just stated. Water, in like manner, is formed of one part, by weight, of hydrogen, and eight of oxygen; and were these elements to unite in any other proportions, some new substance, different from water would be produced. When two or more elements unite to form a compound, the addition or diminution of a small quantity of one, often produces an effect remarkably different to what would have resulted, had the proportions been different. For instance, there is great dissimilarity, both in taste and appearance, between starch and sugar; and yet they are composed of the same elements, and very nearly in the same proportions, as will be seen by the following analysis:—

	Oxy.	Hy.	Car.
Sugar is composed of	40	5	36
Starch	48	13	42

The figures represent the parts of each element, by weight, that form the two substances; so that it will be seen, it is only in consequence of the starch containing a few more particles of its elements than the sugar does, that it differs so materially in its sensible qualities. If we could abstract a few atoms only of the oxygen, hydrogen, and carbon, from the starch, we should convert it into sugar! and in some chemical processes this is really effected. It is in consequence of the beautiful law of nature we have been describing, that chemists are able to tell exactly how much of any substance is contained in any particular compound; for the quantity is always the same, and when it has been once ascertained, it is known always. For instance, sulphate of magnesia is formed of sulphuric acid and magnesia. If the latter be added to the acid till effervescence ceases, it will be found, that any magnesia thrown into the solution afterwards will not combine with the acid, but will fall to the bottom of the vessel; thereby showing that only a certain quantity of magnesia will combine with the acid, to form good Epsom salts.

To Make a Gold Powder.

Dissolve gold in aqua regia, or 2 parts nitric and 1 of muriatic acid. The leaf gold is best to use for this purpose. Then take cotton and soak up all the nitro muriate of gold, suffer it to dry and afterwards burn it on a saucer. Take up the ashes of the cotton and wash then, allowing the water to settle before pouring off, when a fine gold powder will be found at the bottom of the saucer, which must be dried and can be used afterwards in the arts, such as ornament for leather or paper.

Glass may be drilled like metal by keeping the instrument (a common iron drill) moist with a solution of camphor in turpentine.

Dr. Graves in his Clinical Lectures states, as a very remarkable circumstance, that females are but rarely affected with the defect of stammering.