strikingly shown—in equal times the lines fall below the hight due to expansion alone by an amount proportionate to the pressure that the gases would have at 32°. In the early explosions in this diagram, the pressure rises from 13 lbs. before explosion to 60 lbs. after, corresponding to a temperature of 3090°. The dotted line represents, as before, the true expansion curve, including the loss of 420° of heat and resulting diminutions of pressure due to the work done.

The construction of these engines is simple, differing in but few particulars from an ordinary horizontal steam engine. The cylinder and heads, as has been intimated, are cast hollow and kept cool by a current of water passing through them. The gas and air are admitted by a slide valve. The gas pipe is connected to a chamber bolted to the cylinder, and between which and the cylinder the slide valve moves. The gas passes through a small port in the back of the valve into the semicircular channel which covers it, and through this up and out of the valve into the atmosphere. It is then drawn down again by the suction of the piston through a number of small holes into the cup of the valve, and thence into the cylinder. This insures its thorough mixture with the air, while, at the same time, it prevents the possibility of explosion, since there is nowhere any explosive mixture except in the cylinder and cup of the valve, the latter being in open communication with the atmosphere.

An air chamber with openings, regulated by a slide, is placed over the holes in the valve to control the admission of air.

A separate valve on the other side of the cylinder is used for the exhaust. As constructed in the French engines this part is a weak point on account of the great heat to which it is subjected from the escaping gases. In the American engines, a small current of water passes through this valve and entirely removes this difficulty.

The spark for igniting the gas is supplied by a Bunsen's battery of one or two cells, and a Ruhmkorff coil giving from 100 to 150 sparks per second, and is distributed to each end of the cylinder.

To most persons it would probably appear that the great heat generated in the cylinder would be destructive of the surfaces. The writer, however, examined an engine that had been running regularly for a month, using in that time less than a quart of oil, and was surprised to find that the bore of the cylinder and the piston rod, though dirty from deposits of impurities, were not even scratched.

The explosion of the gas is unattended by any noise unless the connections are slack. The only size as yet constructed in this country is $4\frac{5}{8}$ inches diameter of cylinder by $8\frac{3}{4}$ inches stroke, though engines of larger dimensions are in process of construction. A friction dynamometer applied to one of these gave the following result:

Length of lever..................	4 feet
Weight applied..................	7 pounds.
Revolutions per mintue.........	185

16,280 foot-pounds per minute=$\frac{1}{2}$ horse-power.

In France there are engines of 3-horse power and upwards, but with the exorbitant prices of gas in this country, 1 or 2 horse-power is probably as high a power as could economically be obtained from this motor. These engines have the advantage that the expense ceases immediately with the work, which is an especial recommendation where the work is intermittent. They can be started and stopped instantly by merely turning the gas cock. They are absolutely free from danger and do not require the attention of an engineer; hence for small powers they are cheaper than steam. On account of their safety, they are admissable in situations where steam would not be.—*Franklin Journal.*

A CURIOUS EXPERIMENT.—Into a bell glass full of air a central tube is made to carry a slow current of hydrogen. At the end of the tube, which is carried nearly to the dome of the bell glass, electric sparks are made to pass. The hydrogen is immediately ignited, taking the form of small luminous spheres, which rush about in all directions. After a few seconds there are an infinite number of these little luminous globes, which seem to play at hide-and-seek without ever coming into contact.—*Causeries Scientifiques, H. Parville,* 1866.

Correspondence.

One View of Perpetual Motion.

MESSRS. EDITORS:—There is a large class of your readers who are interested and benefited by the insertion of such problems as the "razor question," which you have happily disposed of on the correct basis. The writer came to the same conclusion after examining the expansive theory, and also the suggestion that it might be due to the heat of the razor softening the beard in the process of cutting it. Let any person make a lather from hot water, and take the precautions necessary to shave easy, and then experiment by alternately dipping the razor in hot water and cold, several times repeated, at the same shaving, making due allowance for the novel feeling of a cold instrument being applied at such a time, and the result will not be doubtful.

In a back number, you express a doubt as to what is the popular meaning of the term "perpetual motion." Allow one who had the "mania" when he was a boy, but was cured by experiment and reasoning before he was twenty years of age, to give his opinion.

Perpetual motion is a mechanical device, whose movements shall generate sufficient power to continue those movements, *ad infinitum,* allowing for repairs, which are incident to the wear of all machinery. A prominent idea is, that natural laws, gravitation especially, can be circumvented; but thus early I learned that gravitation could not be cheated; that if a pound was raised a foot high by slight effort, that effort must be continued longer, so that what was gained over weight was lost in time—a law of physical science of great and constant usefulness, when fully comprehended.

I have some respect for "perpetual motion" as an educator, especially to many who have not enjoyed the advantages of scientific training. The various phases of the "hobby" stimulate thought and work out a variety of problems, a knowledge of which cannot fail to be of use in after investigations. What is gained in this way is seldom lost, being the result of experience. I am no apologist for a waste of time and talent expended in foolish attempts to produce the "impossible," but to what extent the effort is to be considered a waste is the real question. The knowledge gained, skill in the use of tools, and schemes exploded, which were worthless, and are not to obtrude themselves again upon our attention, are, in individual cases, at least, ample recompense for their cost.

Those visionary theorists who never see the fallacy of one of their pet schemes, are hardly to be reached by reason or ridicule, and if diverted from their "one idea" for a season, are very apt to recur to it again.

Your pungent and happy hits at this class, are felicitously varied, amusing and very enjoyable.

OBSERVER.

The Cascade of Light.

MESSRS. EDITORS:—You rightly explain the phenomenon alluded to in your last issue by your correspondent "Argent." That portion of the illuminating ray which is tangent to the side of the falling stream, or meets it very obliquely, is reflected continuously around its whole circumference, and thus produces the appearance of a luminous point as broad as the jet and as high as the depth of the ray or pencil of light.

Well may you add that "one of the most brilliant experiments ever exhibited in a lecture room is the throwing of the electric light upon (or rather into) a column of falling water." In this case the jet issuing from the side of the containing vessel, its direction on leaving it is horizontal or tangent to the vertex of the parabolic curve which it describes. In the side of the vessel immediately opposite the point of issue of the jet, is a hole of corresponding size, filled in with a piece of glass or a glass lens, through which the rays from the adjoining focus or source of light are transmitted, concentrated on, and thrown into the flowing column of water, in a direction so nearly that of the initial portion of the jet itself, or so obliquely to its surface, as to be totally and continuously reflected from point to point throughout the whole stream, and down to the very basin in which the water is received, thereby giving it the appearance of a cauldron of liquid fire. The stream may be made to assume any hue, as the mere interposition of a piece of colored glass between the light and lens will necessarily give it the appearance of molten iron, gold or silver, or make it assume the aspect of a column of liquid ruby, emerald, or diamond, etc.

This most beautiful experiment was witnessed some five years ago, at the University here, under the able professorship of the Rev. Mr. Hamel, a young physicist of great promise, who explained the phenomenon in the most conclusive manner.

If the containing reservoir be made a hollow column, with water only in the periphery, the light in the center, a series of holes for as many jets on the outside, a corresponding inner series with appropriate lenses, and a rotating rim of variously colored glass, the numerous jets issuing together from the vessel in streams of liquid fire of beautiful and ever-varying hues, produce the most magical and enchanting effect that can well be imagined or described.

CHS. BAILLANGE.

Quebec, C. E , April 5, 1866.

An Experiment with Clean Iron.

MESSRS. EDITORS :—I have noticed in your journal several communications on the subject of cold or unmelted iron floating when placed in melted iron. And on searching for light on the subject, to-day we tried the experiment of placing a piece of cast iron that had been turned clean and smooth, in a ladle of melted iron, when it sunk immediately and did not rise again. Previous to placing the cast iron in the ladle we put a piece of lead in the ladle. The iron sunk as quickly as the lead and with much the same apparent effect on the melted iron. I have therefore come to the conclusion that the reason of unmelted iron floating is not because of the greater specific gravity of melted iron, but that the cause lies somewhere concealed in the coating of sand scale or rust that usually covers the pieces that are thrown in the melted iron as coolers or for experiment. With this clue perhaps you or some of your correspondents may enlighten us.

J. B. BOYCE.

Lockport, N. Y., March 28, 1866.

Shaving with a Wooden Razor.

MESSRS. EDITORS:—I read in one of your papers a number of years ago, a receipt for a wash or soap that would soften the beard so that it could be removed with a wooden razor. Now I have all the papers, but cannot seem to find it. Can you inform me what number or volume I can find it in?

A. M. S.

Boston, Mass., April 2, 1866.

[Milk of lime, sulphuret of arsenic, or other depilatory, will soften the beard or hair so that it may be brushed off. These things act on the skin, however, more powerfully than on the hair or beard. A person is not very likely to use them a second time.—EDS.

To Recover Gold from Solutions.

MESSRS. EDITORS:—Please inform me in your Notes and Queries how to recover the gold from a plating solution which was spoiled by adding, direct, a nitro-muriate solution of gold to the common cyanide solution. I have Byrne's "Metal Worker's Assistant," but it does not relieve the quandary.

H. & J.

Paoli, Ind., April 2, 1866.

[The bath is probably not injured. To recover the gold, put a stick of bright zinc into the solution. Zinc will precipitate gold from any solution.—EDS.

Tyler's Safety Switch.

MESSRS. EDITORS :—In your valuable paper of January 20th, I noticed a communication from the *Railway Times,* which highly recommends Tyler's safety switch, and as I desire to adopt it on this road, you would be conferring a great favor by giving me the address of the inventor or manufacturer.

J. S. MURRAY.

Cienfuegos, Cuba, March 1, 1866.

[We do not know the present address of Mr. Tyler—should this meet his eye, he will please to address Mr. Murray as above.—EDS.