THE GAMGEE PERPETUAL MOTION.

One of our reporters called upon Mr. Edward N. Dickerson, the civil engineer and lawyer, to get his views with regard to the Gamgee "thermo-dynamic engine" and Chief Engineer Isherwood's report thereon. After reading the extract from Isherwood's report, as published in this paper last week, and after examiniug a copy of Gamgee's letters patent, Mr. Dickerson said that his attention had not been called to the matter before, and that he was somewhat astonished that Isherwood, who had published two or three books in years gone by, and expended millions of the public money in the attempt to prove that there was no power to be got out of expanding steam, should now be found advocating an engine whose entire merit is supposed to consist in the power that will result from the expanding of another liquid following the same laws as water in its operation; and that, in his opinion, the ignorance exhibited in the first publications is equaled by that exhibited in the last. In the first publications he denied the value of the dynamic effect due to expansion, and in the second one he converts that effect into the means of producing perpetual motion!

Mr. Dickerson then went on to say: The truth is, that any gas whatever which is produced by vaporizing a liquid will give out more or less of the value of the heat expended in the production of it, as it is expanded more or less. Isherwood, in the position of Chief Engineer of the Navy, prevented this simple truth from being made available for the United States for many years; and now he is going to the other extreme in assuming that if some other liquid beside water be used, not only an enormous amount of power can be obtained, sufficient to drive navy vessels without fuel, but that this enormous power, produced by means of expansion, has the faculty of restoring the liquid used to its normal condition by its own internal action, when it will be ready to perform the ceremony over again *ad infinitum*.

A simple way to illustrate this whole subject is to suppose a thoroughly exhausted vessel of any kind, into which some liquid ammonia or other low-boiling substance is introduced. If that liquid can derive from the environment heat enough to vaporize it, it will be thoroughly evaporated, and will fill that vessel under a tension corresponding to its volume and heat. When that is done the work of that amount of heat thus absorbed has been accomplished, and the gas will be very cold, if the volume into which it expands bears a large proportion to its normal liquid volume. Now if in that condition, and by reason of this low temperature, this gas could suddenly reconvert itself into a liquid form, it could be very readily replaced in the original vessel, or a similar one, and again derive its heat from the environment and reproduce the original effect. The difficulty about it is that it will not reconvert itself into a liquid, and this is the fallacy of the whole assumption; and in order to reconvert it into a liquid form it must be compressed into its liquid dimensions, when it will again be as warm as it was in the beginning, and when the power expended in reproducing it will be equivalent to that it gave out in the expansion. This general truth may be confused by pictures of cylinders, condensers, and by jargon; but it is altogether probable that this law will assert itself notwithstanding the confusion that will result from such an organization as Mr. Gamgee exhibits in his patent. If not, there is, practically, a perpetual motion machine made.

In all engines operated by heat, whether atmosphere, steam, or the vapors of other liquids are used, a constant condition of disturbed equilibrium must be maintained between the opposite sides of the piston or diaphragm which is to exhibit the motion. One side of it may be made hotter than the ordinary temperature, while the other side need then only be of that temperature, or the ordinary temperature may exist on the one side and the opposite side may be made colder; and whenever that disturbance does occur a tendency of the gas to pass from the hotter to the colder space will exist, and power can be got. But, in order to make an engine operative, that tendency must be made chronic, or in other words, artificial heat must be added at one end, or the natural heat which has been expended at one end must be destroyed at the other by some refrigerating process. I have often said that if I were lecturing in a scientific school I would have a steam engine running in which the boiler should be filled with a mass of ice; and such an engine, which might easily be made, would illustrate the whole subject in a very striking way. Steam at the freezing point has a pressure of about one-tenth of a pound to a square inch; and, of course, if a pressure of about one hundredth of a pound to a square inch could be produced on the opposite side of a piston, ice steam would drive the engine; but it would require artificial refrigeration, and, of course, an expenditure of power at the lower side much more costly than to put an alcohol lamp under the little boiler at the upper side. It never occurred to me, however, that my ice machine would, by the expansion of this ice steam, destroy the heat and restore the ice to its normal condition in the boiler, so as to run in what Gamgee calls a closed circuit.

The best steam engine now existing (which consumes two pounds of coal an hour a horse power) yields about one-tenth of the power which the combustion of the coal would theoretically produce, measured by thermal units. This result is more than twice as great as in Isherwood's engines built upon the theory that there was no benefit in expansion. They required about five pounds of coal an hour a horse power, or more. By carrying expansion further an engine can be easily built that will make a horse power with one pound of coal an hour, or half the fuel now used; and it is undoubtedly true that after steam has been used to its greatest capacity, the remaining heat, which now is discharged overboard in the warm water of condensation, can be utilized in vaporizing low-boiling liquids, such as ammonia, out of which a very considerable further amount of power can be obtained. But it is not worth while to make those attempts until the power to be got from steam has come somewhere near to the practical limits to which it may be carried. At present it is not half way there. When that has been done, and when all the heat possible has been used in vaporizing low-boiling liquids, there is no present prospect that more than a hundred per cent of the power of combustion will be utilized; or, in other words, it is not probable that more heat units will be exhibited in the dynamic effect than are due to the perfect oxidation of the carbon or hydrocarbon of the fuel. In all cases, practically, the limit of fall of temperature must be the temperature of the thermal ocean in which we operate, which is a variable one, affected by geographical position and seasons of the year. When the sea water is 70° hot, there never will be a time in which power can be obtained upon the assumption that a greater degree of refrigeration than 7° is possible without expense; and it will always be cheaper to raise the temperature at the other end by fuel than to lower it at the minus end by artificial means.

There is only one other set of experiments that I know of analogous to these, and they are to be found in Isherwood's "Experimental Researches in Steam Engineering," between pages 2 and 55, in which he was trying to find out a method by which steam, after leaving the boiler, could superheat itself, and in which he concluded that, although it did not do so in the particular set of trials he made, yet, if the machinery had been bigger, he thought it would! The converse of the proposition is now involved, in which the analogue of steam is *cooling itself*, and in which it would require probably a larger machine than they will be likely to make in the Navy Yard to establish a successful result!

INSECTIVOROUS PLANTS.

In your issue for May 14, 1881, reference is made to the later experiments of Sig. Vayreda with some of the different species of *Silene* (catch-fly), in which he arrives at the conclusion that the plants do not digest the insects, or if they do, they are not benefited thereby any more than if they did not eat them.

During the summer of 1878, assisted by Mr. Wm. I. Tait, of Jersey City Heights, N. J., we made most careful and exhaustive experiments with the Carolina fly-trap (*Dionea muscicipula*), and arrived at exactly the same conclusion as Sig. Vayreda has done, that the so-called "feeding" of the plants in no way conduced to their health or vigor, being identical in all respects with those that had not been given the insects. One hundred healthy plants were used in each of the two experiments. The whole details of the experiment were given in the *Gardeners' Monthly*, of Philadelphia, in December, 1878, and brought out a very interesting discussion from those believing in the Darwinian theory and those who did not.

But why because the exudations from a plant are such as to cause an insect to adhere to it, or its mechanical formation entrap the insect, we should jump to the conclusion that it should then feed on its prey, it is hard to imagine.

On the "cruel plant" (*Physianthus albens*) hundreds of moths, butterflies, and other insects may be seen any day in August when the plant is in bloom—dead and dying, firmly held by their antennæ. Professor Geo. Thurber thus describes the trap contrivance by which the insect is caught: "The anthers are so placed that their spreading cells form a series of notches in their ring around the pistil. The insect in putting its proboscis down for the honey must pass it into one of these notches, and in attempting to withdraw it the end is sure to get caught in a notch, boot-jack fashion, as it were, and the more the insect pulls the more its trunk is caught." Thus caught, the insect starves to death, hence the well deserved name of "cruel plant." Now, here is a trap nearly as wonderful as that of the Carolina fly-trap, and far more so than that of the viscid exudations of the *Silene;* yet even Mr. Darwin would hardly say that the "cruel plant" feeds on these insects, any more than that the gnats caught by millions by the resinous exudations of the hemlock tend to augment their growth, or that the thistle or burdock of the wayside owe any part of their health and vigor to the scores of butterflies, moths, or bumble bees that are in their headlong flight impaled on their spines.

PETER HENDERSON.

Jersey City Heights, N. J., May 9, 1881.

SILK ADULTERATIONS.

[A simple test, showing quality and value of all silks.—Cracking, greasy, and dull wearing silks easily detected.]

Having proved by numerous experiments that all pure silk burned in a gas flame yields in ashes two-fifths of the original weight, and that all weighted silks, when burned in a gas flame, weigh less than two-fifths in proportion as they are weighted, and where there is much iron, "the chief adulterant," the color of the ash is a red brown. From pure silk the ash is always black, and the silk while burning seems to melt and run together, while the weighted silk keeps its form, shrinking equally from all parts. It is not necessary to burn any pure silk "unless comparisons are desirable," if you take the fact as established that the resulting ash is two-fifths of the original weight, and all silk not coming up to that standard is proportionately weighted.

The theory is: pure silk leaves a residue of two-fifths when burned to ash, and the weighted leaving very little ash from anything but the silk it contains, the adulterants being principally converted into vapor and gas, pass off, leaving no perceptible weight of residue.

The best method of burning the silk for testing is to lay it on a piece of wire gauze and let the gas flame pass through.

SCALE.

20	parts	silk	yielding	8	in ashes	is	pure	silk.
20	"	"	"	7	"	"	"	⅞ "
20	"	"	"	6	"	"	"	¾ "
20	"	"	"	5	"	"	"	⅝ "
20	"	"	"	4	"	"	"	½ "
20	"	"	"	3	"	"	"	⅜ "
20	"	"	"	2	"	"	"	¼ "
20	"	"	"	1	"	"	"	⅛ "

A very good idea of the purity of silk is shown by comparison: taking a piece of ribbon—any pure color, white, blue, pink, gold, or any bright color—"one inch or two is sufficient," weigh carefully; then weigh exactly the same weight of silk to be tested, and as much as it falls short in measurement with the pure silk it is weighted. Endeavor when testing as above to get a piece of ribbon the same substance as that to be tested.

When it is considered that the weighting is a very expensive process, and that the additional weight does not in proportion add to the bulk, and that the strength, durability, softness, and luster are greatly impaired, 'tis strange that the fraud is persisted in; but it being so, and the consumer must necessarily pay the expense of the adulteration, it is for them to understand how to protect themselves.

There are many black silks that are valued by weight, manufacturers and dealers agreeing as to the dyed weight; such is what is termed French twist, often returned by the dyer three pounds for one. This silk twist is made from waste, and as it is cut up and carded there is a great amount of fine fiber on the surface, causing a dull and woolly appearance. In the process of dyeing the silk is rotted by the many baths of nitrate of iron and other chemicals; the fiber on the surface becoming very tender is beaten off, leaving a smooth hard twisted thread; but the processes are so detrimental to the strength, its use is confined to cutting up into fringes, but it soon shows its components, in becoming dull and cottony.

This French twist costs in the gray about four dollars per pound, and the dyeing heavy weight two dollars and fifty cents, so when finished there is returned three pounds for six dollars and fifty cents, or two dollars and sixteen and three-quarter cents per pound. If dyed in the regular way, sixteen ounces would return twenty and cost fifty cents for dyeing. So in that way the good silk would cost four dollars and fifty cents for twenty ounces, or three dollars and sixty cents for one pound, against two dollars and sixteen and three quarter cents for the heavy weighted. Let it be understood that the same number of yards and the same amount of good silk is in twenty ounces, costing four dollars and fifty cents, as in the forty-eight ounces heavy weighted, costing six dollars and fifty cents, and that the four fifty silk is clean and strong, while the six fifty is dirty and rotten. So the advantage is hard to be understood, and perhaps is only in the fact there are yet very many who can only understand a pound is a pound and a yard is a yard and silk is silk.

It is, however, gratifying to know many of our manufacturers depend on excellence. This, when understood by the consumer, will be found to mean the best economy.

New Haven, Ct. LEWIS LEIGH.

City Area and Sewerage.

Cities, Dec. 31, 1880.	Area in acres.	Population by census of 1880.	Density of population per acre.	Linear feet of sewers per head of population.
New York	26,401	1,206,577	45·70	1·69
Philadelphia	82,803	846,980	10·23	1·25
Brooklyn	13,338	566,689	42·49	2·81
Chicago	22,797	503,501	22 00	3·54
Boston	4,416	362,535	82 00	2·91
St. Louis	40 000	350,522	8·76	3·04
Cincinnati	15,360	255,707	16 64	0·98
San Francisco	26,880	233,965	8·70	2·82

Prints on Linen.

Copies of drawings or designs in black and white may be produced upon paper and linen by giving the surface of the latter two coatings of:

Gum arabic	7 to 10 grammes.
Citric acid	2 to 3 "
Iron chloride	4 to 6 "
Water	85 cub. centimeters.

The prepared material is printed under the drawing, and then immersed in a bath of yellow prussiate of potash, or of nitrate of silver, the picture thus developed being afterward put in water slightly acidified with sulphuric or hydrochloric acid.

A LARGE CRANK SHAFT.—The crank and crank shaft of the City of Rome, the new Inman liner, are approaching completion at Messrs. Whitworth's. The crank has three throws, each piece weighing about 20 tons, and the whole about 61 tons, while the shaft of fluid compressed steel forged hollow will weigh 18½ tons when finished.

Society of Mechanical Engineers.

The American Society of Mechanical Engineers met in Hartford, Ct., May 4. Though but a year old, the society has acquired an honorable standing and a large membership. About fifty new members were received at the first session. Professor R. H. Thurston occupied the chair Papers were read by the president and by A. R. Wolff, of this city, on "Ratios of Expansion at Maximum Efficiency." At the second session Mr. Alex. L. Holly called attention to the dependence of this country upon foreign manufacturers for large steel forgings, owing to our lack of heavy steam hammers. Mr. Holly anticipated the supplanting of forgings in a great measure by steel castings, which are already made of high tensile strength.

Professor Thurston remarked upon the empirical character of the practice of depending upon familiar rules and formulas in the construction of steam engines. While standard tables, so called, like those of Regnault or Rankine, on pressures of steam due to temperature, might be accurate and very nearly exact, they were not absolutely so under all conditions, and he urged that engineers should depend upon observations derived from the actual conditions of the special case in hand.

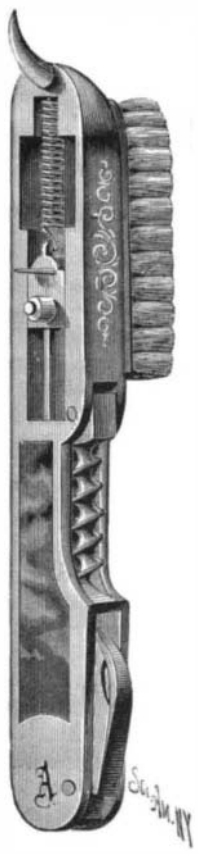
Chas. E. Emery, Esq., in a brief paper pointed out the value of non-conductors as a means of preventing radiation in steam pipes, and from a series of experiments presented the following substances in the order of their mention as valuable: Hair felt, mineral, wool, sawdust, charcoal dust, wood, loam, slack lime, asbestos, ashes, brick dust, sand, air, and space.

Cold Air for Domestic Use.

The *Chronique Industrielle* gives an abstract of a paper by a French engineer, M. Mougey, of Bray-sur-Seine, wherein the author shows the benefits to be derived from a system proposed by him for distributing cold air through a line of pipes to private consumers. Some such system has been suggested before, but the one under consideration differs from it in the fact that the projector proposes to compress the air to a greater degree (5 or 6 atmospheres), and to *cool* it before sending it through the pipes to the various points of distribution. At these points the opening of a cock, by allowing the air to escape and expand, will distribute throughout cellars, living apartments, or wherever else it may be needed, a pure cold air capable of preventing fermentation or putrefaction of organic matters, and of rendering the atmosphere of stores, manufactures, or dwelling houses refreshing during the most sultry days of summer. The air thus compressed may also be used, like steam, as a motive power. As for the proposed mode of distribution, that is essentially the same as now employed for supplying steam heat to consumers in Lockport, N. Y.

NEW CAN AND BOTTLE OPENER.

The engraving shows an improved opener for cans and bottles, recently patented by Mr. I. N. Arment, of Dayton, Washington Ter. On the top of the main bar forming the handle of the several parts, is fixed a brush for cleaning off the top of the can or bottle. On one side, and near the center of the handle, there is a groove in which is pivoted a corkscrew which is held in either of its positions by a spring in the bottom of the groove. In one end of the handle is pivoted a short, stub knife blade, to be used for cleaning off wax, cutting wires, etc., and at the opposite end there is a sharp curved spur which is designed to be thrust into the center of the top of a can. This end of the handle is slotted and contains a follower which carries a pointed double-edged knife and a small roller. The knife is to be forced into the top of the can, and the roller presses the side of the can at the top, to guide the knife.



Novel Can and Bottle Opener.

A spiral spring is attached to the end of the handle and to the follower, and tends to draw the latter toward the end of the handle. This device insures a contact of the roller with the side of the can.

This tool, unlike many combination tools, is convenient and useful in all of its parts.

Conflicting Trade Marks.

The following decision indicates the way trade marks are sustained in England: A firm of brewers shipping to the colonies had put on their trade label the words "Bulldog Bottling." Another firm, also exporting to the colonies, had adopted, perhaps from want of originality, the words "Terrier Bottling." The users of the word "Bulldog" applied for an injunction against the use of the word "Terrier," and the Master of the Rolls, being of opinion that the labels could not be mistaken, declined to grant it. The Lords Justices, however, finding that the "Bulldog" beer had acquired the name of "Dog's head," reversed the decision of the Master of the Rolls, on the ground that the nature of the "Terrier" label would lead to its being described by the same name.

NEW MOLE TRAP.

We give an engraving of a simple and effective mole trap lately patented by Mr. Henry W. Hales, of Ridgewood, N. J. As will be seen from the engraving it may be set over the mole run without disturbing the ground in any way, or offering any obstruction to the free passage of the animal. The trap is so constructed that it may set very near to plants and flowers without injuring them, and it may be set close to a wall or fence without interfering with its working.

HALES' MOLE TRAP.

The trap consists of a vertical frame terminating in two pointed stakes at the bottom, which are wide enough apart to admit of pushing them into the ground on opposite sides of the run without disturbing the earth or changing the form of the run.

A follower fitted to slide in the vertical frame carries six long, pointed pins, three on each side of the frame. This follower is pushed downward by a strong spiral spring, and is retained in an elevated position by a lever extending through a mortise in the side of the frame and downward where it is engaged by a trigger. The trigger is furnished with a wide flat foot which rests upon the ridge of the mole run which is slightly depressed.

Now, when the animal attempts to go through the slightly contracted portion of the run the trigger is raised and the trap is sprung.

For convenience in setting and placing the trap, the square rod, extending upward from the follower through a square hole in the top of the frame, is rounded at a single point for a short distance, so that when the follower is raised until the round part of the rod is in the mortise in the frame and the rod turned as indicated in the detail view, the follower will be retained until the trigger and lever can be arranged, after which it may be again turned to bring it into position to operate. The trap is made entirely of metal, and is very simple and effective.

Statistics of Color Blindness.

The report of the committee appointed by the Ophthalmological Society of London, to collect statistics of cases of color blindness, presents many features of special interest. The secretary of the committee, Dr. Brailey, with the assistance of sixteen colleagues, has examined 18,088 persons of all classes, of whom 1,657 were females. It is at once curious and suggestive to find that while the average percentage of color defects among men is 4·76, and 3·5 for very pronounced defects, it falls in women to the low figure of 0·4. This, if true, remarks the London *Lancet*, would seem to suggest a new sphere of labor for women. If women are comparatively free from color blindness, they are so far specially indicated for many of the less laborious occupations in which good color perception is desirable or absolutely indispensable. It is satisfactory to find that these last statistics confirm, in the main, those collected by the late Dr. George Wilson, of Edinburgh, nearly thirty years ago. This is especially noticeable as regards the comparative frequency of color defects among members of the Society of Friends, particularly among the poorer section of them. Though the members of the Ophthalmological Society seem either not to have known the fact or to have forgotten it, Dr. Wilson found a considerable number of cases of color blindness among the members of the Society of Friends, and he was of opinion that this was not an accidental circumstance. He further believed that the largest proportion of cases of color blindness would, on extended examination, be found among the less accomplished male Friends in the larger cities.

A Japanese Bronze Worker.

The most skillful living bronze worker in Japan, and one of the most skillful of workers in metal that Japan has ever possessed, is said by the *Japan Mail* to be a Kiyoto artisan named Zoroku. His specialty is inlaying with silver and gold, an art which he carries to such perfection that his pieces are scarcely distinguishable from the *chefs-d'œuvre* of the Min period. What one sees on going into his *atelier* is a very old man—some 65 or 70—peering through a pair of huge horn spectacles at a tiny incense-burner or still tinier flower vase, from whose frets and diapers he is paring away, with marvelous patience, an almost imperceptible roughness or excrescence. Beside him, winter and summer alike, stands a brazier with a slow charcoal fire, over which an iron netting supports one or two bronze vessels similar to that he holds in his hand. Plainly these bronzes are being subjected to a slow process of baking, and if you watch for a moment, marveling at the purpose of a proceeding which seems only calculated to mar the fair surface of the metal, you shall presently see the old man dip a feather into a vessel filled with greenish liquor, and touch the heated bronze here and there with the most delicate and dexterous care. This liquid is acetate of copper, and this patient process, which you see repeated perhaps twenty or thirty times during a visit of twice as many minutes, will be continued in the same untiring fashion for half a year to come, after which a month's rubbing and polishing will turn out a bronze rich in green and russet tints that might, and indeed must, you would fancy, have been produced by centuries of slowly toiling time.

IMPROVED FRUIT JAR.

The engraving shows a fruit jar whose cover is retained by a wire bail carrying a roller, the wire being bent so as to retain the roller in its central position, and to form bows extending away from the pivots to increase the leverage in moving the bail. The cover has an arch across it, the surface of which is two arcs of circles of shorter radius than the bail, so that the movement of the bail across the arch causes the roller to press the arch and cover and bring the cover down tightly upon the packing of the bottle or fruit jar, and the roller remains in the slight depression formed in the surface of the arch.

Reilay's Fruit Jar.

This invention has been patented by Mr. Richard B. Reilay, of Wilkesbarre, Pa.

A New Cattle Car.

A "parlor" cattle car, with twenty head of cattle, arrived in this city the other day from Cincinnati, the cattle having come through without unloading. The cattle were fed and watered by a mechanical contrivance operated from the end of the car. With an ordinary car the cattle would have had to be unloaded for feeding three times, with considerable injury and delay. The superiority of the new car was shown not only in its increased capacity and the superior comfort of the animals, but also in the saving in weight by diminished loss, which is usually about ten per cent. With the "parlor" car the loss was under three per cent.