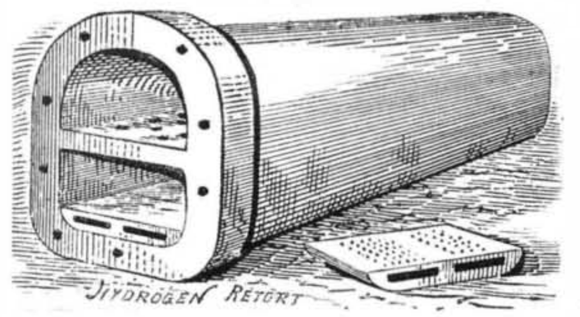
A NEW IMPROVEMENT IN GAS MANUFACTURE.

There are few subjects of public importance which are just at present engaging a greater share of the attention of scientific men than the economical production of illuminating gas. The English technical journals—owing in no small measure to the recent coal famine, coupled with the knowledge of the fact that, of the hundred millions of tuns yearly drawn from the mines of the kingdom, fourteen per cent of the aggregate amount is used for lighting purposes, and hence rendered unavailable for industrial or domestic employment—have, of late, been filled with references to the manufacture of gas from petroleum products, resinous substances, and from coal by improved and less expensive systems.

In our own columns we have already presented our views, as well as those of many valued correspondents, regarding the advantages to be derived from the general adoption, in this country, of processes for the utilization of other materials than coal for the purpose noted. Several valuable systems have been patented; and notably some for the use of petroleum and other hydrocarbon oils are in actual employment. Of the relative merits of the different plans, or as to the estimation in which they are held by those using them, it is not our intention here to speak. Suffice it that, considering any or all in comparison with the employment of coal solely, the question of cost of transportation of the latter forms an important argument in their favor; and hence, so far as we can learn, gas companies and engineers generally manifest no lack of willingness to entertain or experiment upon suggestions or inventions having for their first object the reduction of this very material item of expenditure.

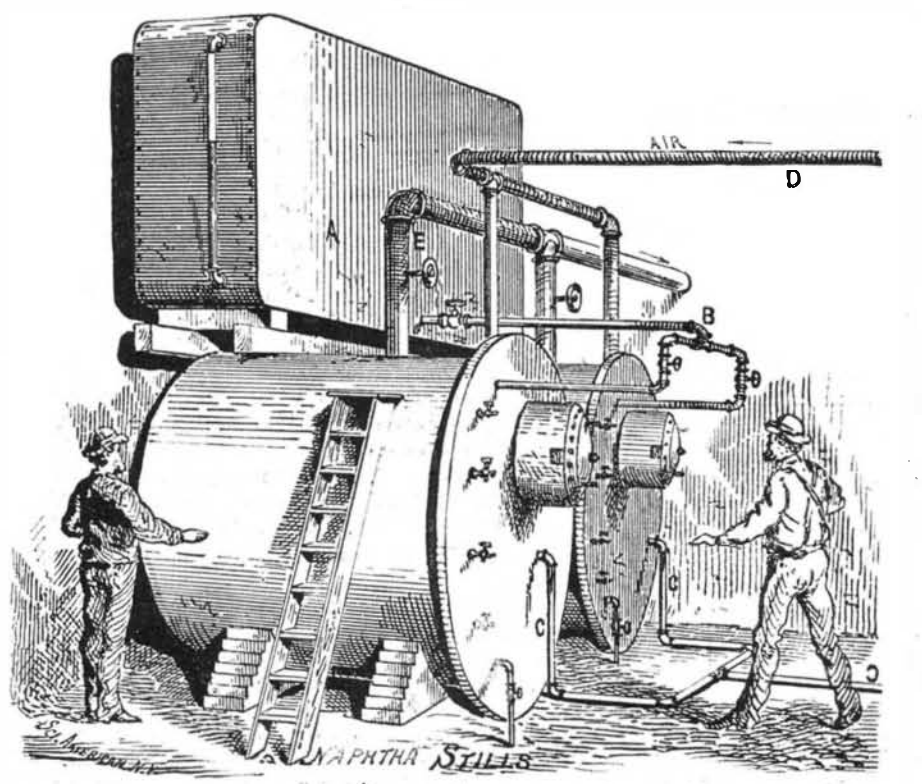
As an instance in proof of this latter assertion, the Citizens' Gas Light Company, of Brooklyn, N. Y., have recently

FIG. 2.



introduced, in their works, apparatus for the manufacture of hydrogen, by the decomposition of steam under the Gwynne-Harris or American hydrocarbon process, and also for the preparation of naphtha gas, both of which products are mingled with that obtained in the ordinary way from coal. As a result, we are told that, as against 28 benches or 140 retorts in use in October, 1872, at present but 14 benches are employed, two of which generate hydrogen, two naphtha gas, and the rest coal gas, supplying the full amount required, and yet working only from 14 to 15 hours per day. The process, briefly stated, is threefold: first, coal which produces the ordinary quantity of gas, but of inferior quality, is carbonized in separate retorts; second, hydrogen, generated in the manner about to be described, is mingled with the coal gas, giving it high incandescent power, and, besides, taking up hydrocarbon vapors which otherwise would be lost; third and last, naphtha gas, or any of the petroleum products, which may be made of almost any richness that it is possible to burn, is led into this mixture, insufficient proportion to produce the requisite degree of illuminating power. In other words, coal gives coke for fuel to run the works, and common gas; hydrogen takes up the carbon vapors, and adds heat to the flame, thus creating more perfect combustion; and naphtha increases the lighting power to any desired standard.

FIG. 1.



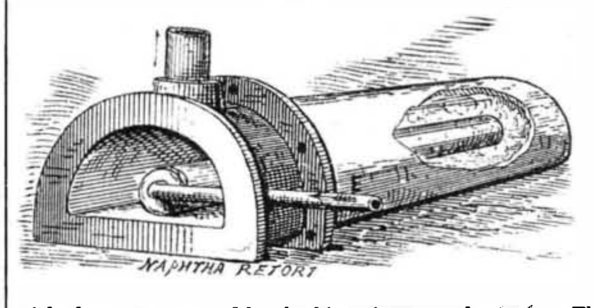
Using coal alone, we are told that 9,026 feet of gas per tun was about the yield with the full complement of benches. Now, 13,000 feet of coal gas and hydrogen mixed is produced, or an average of about 6 feet per pound of coal, which may be increased by increasing the hydrogen.

As the hydrogen and naphtha processes are quite distinct, we shall refer to each in detail, separately. In our large engraving (Fig. 4) the artist has shown the exterior of the hydrogen bench, and in the smaller engraving (Fig. 2) is represented one of the retorts here used. The latter, though of the general shape and of the same material as the ordinary gas clay retort, differs from it in that it has a diaphragm extending horizontally across the center, forming a double retort, and is, besides, covered at the bottom with tiles, one of which is represented separately. The diaphragm is perforated with medium sized openings. The tiles have smaller holes in their upper surfaces, communicating with other apertures which, when several tiles are laid side by side, form two longitudinal passages through them. Thus arranged, three retorts are placed in each bench, in the usual manner, and, when in use, are filled with anthracite coal. Once in a day, the coal is raked back, and about a bushel of anthracite is thrown in; and once in each week the retorts are refilled.

From an ordinary cylindrical boiler, steam is led to a superheater, and thence to the vertical pipe, marked A in our large engraving (Fig. 4). Following its course for the retort on the right, the steam escapes from tube, A, into two pipes which lead to the dryers, the ends of which are represented at B. Near the junction of the pipes with tube, A, are placed suitable valves to regulate the supply. The dryers, B, are made double; that is, the steam enters an inside metal tube, by which it is carried back five feet into the bench, and then passes to and through an inclosing metal tube, back to its starting point. This is intended to prevent any wet steam from reaching the clay superheaters or retorts in the bench; and, finally, the steam passes out by two upwardly leading pipes, which terminate each just above a retort, at C. At the latter point, each pipe connects with a short tube which joins it with clay superheaters placed just above the retorts, so that the steam, entering at C, travels to the rear of the superheater, which is five feet in length, and then returns, highly heated, in an opening parallel to the front, making its exit by the tubes, D. In the latter it is conducted down under the lower portion of the retort into the longitudinal passages formed through the tiles. Hence, it escapes up through the perforations and through the incandescent coal, and is decomposed, forming hydrogen and carbonic oxide gas.

The gas thus generated by this American process passes into the hydraulic main, and thence is conducted to mingle

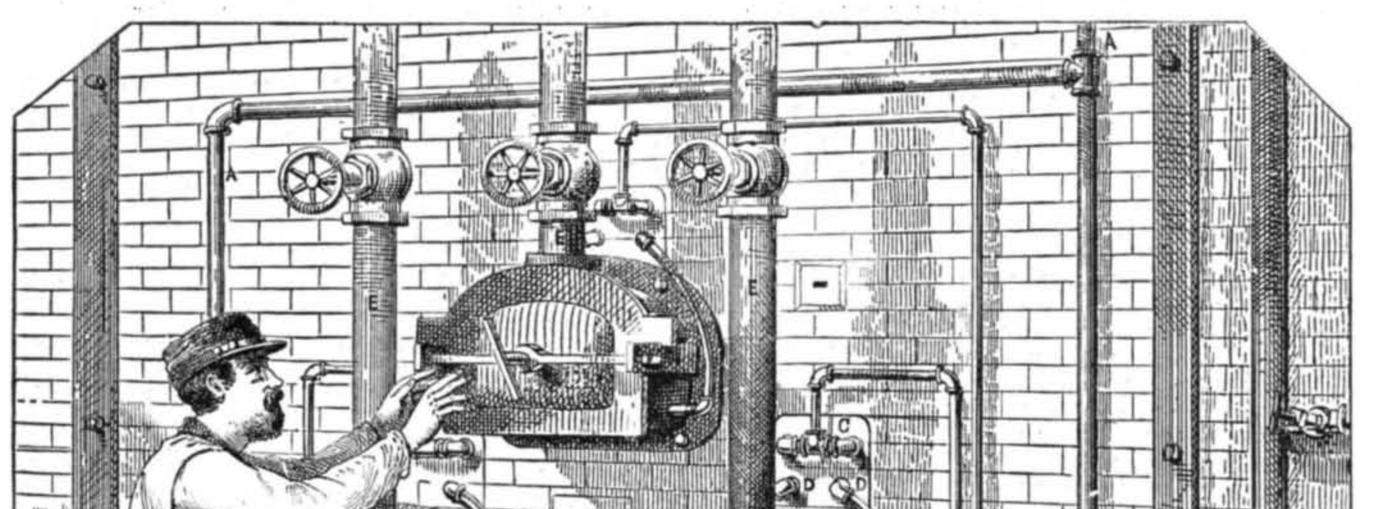
FIG. 3.



with the gas generated by the bituminous coal retorts. The product of the two hydrogen benches is in the neighborhood of 100,000 feet per day, and its estimated cost is, at outside figures, 30 cents per 1,000 feet.

The naphtha employed is deposited in a suitable reservoir at some distance from the works, whence it is pumped as desired into a tank, marked A in Fig. 1. This receptacle receives its supply in order to deliver it by the pipes, B, into the two huge cylindrical stills. Within the latter is a worm pipe which is filled with steam from the boiler by the pipes, C. By means of a fan blower in the engineroom, a current of air is driven into the stills by the pipes, D, which mingles with the vapor of the naphtha given off through its heating by the interior steam coil. The gas then passes from the stills by tubes, E, into the works, where it enters peculiarly arranged retorts, one of which is shown in Fig. 3. It will be noticed that the vapor is conducted

FIG. 4.



IMPROVEMENT IN GAS MANUFACTURE.—THE HYDROGEN RETORTS to the back of the receptacle by a pipe, whence it escapes.

After heating, the gas is conducted to a condenser, where it passes through a series of pipes surrounded by cold water, and from which it is drawn by an exhauster and carried to the station meter, whence it goes to the main to mix with the coal and hydrogen gases. About 300 feet of gas per minute are thus made, a gallon of naphtha giving some 135 feet. This is of a uniform quality of 22 candle power.

The mixture of the three gases, as supplied to consumers, averages about 18 candles; and by carefully observing proper proportions in combining them, we learn that a very fine silver white light is obtained.

The process is unquestionably one of considerable economy to the gas company, as is evident from the large saving in the number of hands employed, due to the decreased number of benches used. Moreover, the raw material for the hydrogen, or anthracite gas, costs almost nothing, and a portion of the anthracite coal used is available for re-employment as fuel under the steam boiler. Naphtha is not costly; no cannel coal is required, and the gas coal, as we have already observed, is of the type only serviceable in its production of the usual quantity of inferior gas. The main object of the bituminous coal benches, where hydrogen and naphtha are used, is to make coke for fuel to run the works.

Correspondence.

The Perpetual Motion Seeker.

To the Editor of the Scientific American:

Perhaps no enthusiasts are more contemptuously regarded by society in general than those who waste their energies in searching for a perpetual motion. Even persons who have little or no knowledge of the principles of mechanics never fail, upon a mere mention of the subject, to testify unmeasured disapprobation of the fruitless scheme, and, as a term of reproach to any whose visions appear to be Utopian, speak of their efforts as "savoring too much of perpetual motion." Orthodoxy regards the victim of this hallucination as an object of horror, his pursuit showing that he believes he can create; men of science avoid him altogether, or, at best, regret the ignorance that prevents him from appreciating the fact that motion is an equivalent term for expenditure; and the whole world expands into a broad smile when the victim of this very prevalent mental disorder reveals the weakness that possesses him. It is lamentable and extraordinary that at this day, when no end of opportunity is afforded to even the poorest person to thoroughly educate himself in all branches of knowledge, no less than one hundred thousand individuals in the United States alone are wasting time and substance in this seductive and barren pursuit. So infatuated do they become by long application that defeat but stimulates desire, until, disappointed, impoverished, disheartened and despised, the poor victim often seeks the suicide's grave.

An opportunity was afforded me some months since to interview a veritable perpetual motionist, who was said to have expended fourteen thousand dollars in constructing models, and who now believed himself upon the verge of reaping the reward of his exertions. A ride upon a street railway car to the end of the route, and a walk across open lots brought us to his cottage, whither he had retired from the crowded city, as he explained, that he "might uninterruptedly pursue his invention to a successful conclusion." We were permitted to enter the workroom containing his last model. It consisted of the usual combination of gear wheels, balance weights, springs and compensating levers; it was of very large dimensions, and so elegantly made that we at once recognized him as a superior mechanic. He experienced much satisfaction in explaining the principle of its operation; he talked learnedly of "the surplus power retained by relative levers of unequal fulcrum;" he was querulous on the subject of a criticism which his views had evoked from some previous visitor; he spoke feelingly of the "untimely death of Thomas Babbage, who was called away on the very eve of completing his calculating machine, thereby giving a victory to those who doubted his ability to accomplish the object of his ambition"; and he expressed a hope that he himself might live to rebuke a cold world, by giving it what it scorned to believe possible, a powerful self-motor. His wife, a pale anxious woman, had left the sewing machine at which she had been at work (and which was doubtless the chief support of the family) and, accompanied by her little son, listened to the conversation. Our failure to acquiesce in her busband's views gave her a moment's apparent concern; but the cloud passed quickly from her mind, and she manifested the touching confidence of a woman's loving nature. George Howard is dead. His model was purchased by a speculator who is now applying a secret actuating attachment, preparatory to exhibiting it, in our large cities during the coming winter, as a real perpetual motion. FORFEX.

The Lamp and the Spectroscope.

To the Editor of the Scientific American:

For the benefit of those who have met with difficulties in examining a spectrum, caused by extraneous light emitted by the Bunsen flame used to render the substance under examination incandescent (especially when the flame is colored by the salts of strontia, lithia, etc.), and also the light emitted by the flame used for illuminating the scale, permit me to describe a simple piece of apparatus which very effectually shuts off the extraneous light.

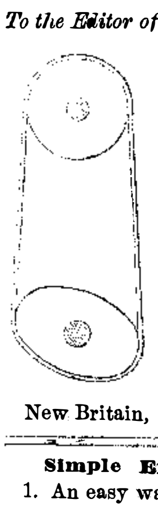
While recently engaged in examining the spectra of the alkalies and alkaline earths, I was exceedingly annoyed by difficulties from the above named sources; and I cut a circular piece of cardboard about nine inches in diameter, with a hole in the center large enough to slip on the extremity of the collimator tube, carrying the slit and the prism of comparison. This entirely conceals the light of the Bunsen flame. If you cut a second piece, of a similar size and shape, and slip this on the eye piece of the telescope, or on the tube carrying the scale, by inclining it at a proper angle (which may readily be determined by the experimenter) a point will be reached which shades the eye from the second light. One of the chief merits of the plan is that, instead of keeping one eye shut, as was formerly the case, both eyes can be open, thereby not tiring the disengaged eye.

By employing this device the faint lines in the spectrum, as, for instance, the faint yellow line of lithia, are more distinctly shown than by any other means. C. A. DAVIS.

Philadelphia, Pa.

Elliptic Pulleys.

To the Editor of the Scientific American:



Elliptic pulleys, such as here shown and now used at this place for driving automatic machines requiring a differential movement, are found efficient substitutes for elliptic gearing; and where applicable, they will be found preferable for obvious reasons. The diameter of the upper pulley should be a mean between the transverse and conjugate diameters of the elliptic pulley. The distance between centers of shafts, as now used, is about twenty times the difference between the transverse and conjugate diameters of the elliptic pulley. Ordinary leather belts are used.

New Britain, Conn. F. H. R.

Simple Experiments for Young Chemists.

1. An easy way to prepare an invisible gas, that will burn with an intense heat, is to put some nails or strips of sheet zinc in an old bottle with a good, tight cork. The cork has a hole bored in it, and a clay pipe stem, or better, a piece of glass tubing with a fine opening at one end, is fitted into the cork. The zinc is covered with water and a little sulphuric or other acid added. The effervescence is violent; and if the cork is put in, the gas will escape through the tube. After waiting several minutes, wrap the bottle in a cloth and apply a match to the end of the tube, when the gas will take fire and burn with a colorless flame. If any air still remains in the bottle, an explosion will take place. Hold a cold white saucer in the flame, and it will soon be moistened but not blackened. This gas is called hydrogen, because, when it burns, it forms water.

2. To imitate the delightful odor of rotten eggs, it is only necessary to place some pieces of the sulphuret of iron in an old bottle and pour on water and oil of vitriol. The sulphuret of iron is made when iron filings and sulphur are heated together. If the bottle in which this vilely smelling gas is prepared has fitted to it a tight cork and a glass tube bent so as to conduct the gas under the water in a second bottle, much of it will be dissolved and can be bottled up and preserved for several days. This gas is called sulphydric acid, and must always be prepared out of doors.

3. To produce light, flaky clouds in a clear liquid, dissolve a piece of alum in water and to the clear solution add ammonia (spirits hartshorn) and stir or shake it. The clouds will be colorless and almost invisible. To another solution of alum, add just enough carmine or indigo to color it distinctly, then pour in some ammonia. The clouds will now be red, or blue, and as they gradually sink to the bottom will leave the solution colorless. This illustrates the method of preparing what are known as "lakes." The clouds thus formed are the hydrated oxide of alumina.

4. To convert a colorless liquid to an orange red, dissolve some tartar emetic in water and drop in some of the solution of the vilely smelling sulphydric acid. (See No. 2.) Next put some tartar emetic into a bottle with zinc and sulphuric acid, as described above (No. 1) for making hydrogen. After waiting long enough for all the air to be expelled, ignite the gas and place a cold saucer in the flame, when it will be blackened; and the spot thus formed, which is metallic antimony, will not dissolve in a solution of bleaching powder.

5. Analogous experiments could be performed with acid solutions of arsenic, but, owing to its poisonous nature, we would advise our young friends to avoid its use. The sulphydric acid would form a yellow precipitate instead of a red one, and the black stain on the saucer would be readily dissolved by chloride of lime, or bleaching powder.

6. To produce a strong smell by mixing two dry powders, each without smell, take pulverized sal ammoniac and stir in a little dry whitewash lime. A pungent ammoniacal odor is evolved.

7. In one tumbler or wine glass of water, place a single drop of oil of vitriol, in a second place some carbonate of ammonia, in a third some hydro-fluo-silicic acid and alcohol, in a fourth some bichromate of potash. Drop into each of these glasses some barium chloride. In three of them a white precipitate is formed, in the fourth a yellow one. Dip a clean platinum wire in the barium chloride; then hold it in a colorless gas or alcohol flame, and a green color is produced. The green fires in theaters are made with this substance.

8. To convert a fair complexion into one of African hue, persuade some fair lady to improve her complexion with bismuth pearl powder (many do it voluntarily); then let her enjoy the perfume of the sulphydric acid, and she will gradually blacken. A curious instance of the action of water on an acid solution is noticed by dissolving subnitrate of bismuth in muriatic acid, and then pouring it into a glass of water, when it gives the latter the appearance of milk.

9. To prepare a gas heavier than air, place some pieces of chalk or marble in a deep jar, or in a bottle like that used for hydrogen, and pour some muriatic acid on them. Effervescence takes place, and a taper lowered into the jar is extinguished; or if the gas, which is called carbonic acid, be collected in another vessel, it may be poured from one vesse to another like water. The substance formed when marble is dissolved in muriatic acid is called calcium chloride, and may be used for some interesting experiments: Fill three glasses with water, and to the first add a little sulphuric acid, to the second some carbonate of ammonia, to the third some oxalic acid and ammonia. On pouring the solution of calcium chloride into these glasses it will in every case form, unless too dilute, a milky liquid.

10. To produce an intensely blue liquid, make a solution of blue vitriol, so dilute as to have but a faint color, then add ammonia, and it becomes intensely blue. To another portion add yellow prussiate of potash and it turns a reddish brown.

11. To make blue glass, bend a piece of platinum wire to a hook at the end and heat red, then touch it on a bit of borax and heat until the latter melts to a little bead. Now dip it into some nitrate of cobalt and heat, when a fine blue glass bead will be formed.

12. To form a yellow precipitate, in a yellow solution, take a weak solution of bichromate of potassium and add sugar of lead; the effect is very pretty.

13. To produce a beautiful purple, take a dilute solution of chloride of gold and add a little chloride of tin; the color formed is known as purple of Cassius.

14. To pour red, blue, and black ink from one bottle, fill three glasses with water, and into one put a little sulphocyanide of potassium, in another some yellow prussiate of potash, in a third a solution of gallic acid, or nut galls. Dissolve a small nail in muriatic acid and dilute the solution. On putting a drop of this chloride of iron into each of the glasses, the three colors will be produced.

15. Yellow and white can be formed similarly by pouring acetate of lead into glasses containing bichromate of potash and sulphuric or hydrochloric acid, respectively. The white chloride of lead dissolves in boiling water and crystalizes on cooling. Sulphydric acid blackens lead.

16. Red, yellow and black are produced as follows: put some potassium iodide in one glass, bichromate of potash in a second, and sulphydric acid in a third. Pour corrosive sublimate slowly into each, and the three colors will appear. Into a clean glass put a little corrosive sublimate and add potassium iodide, carefully; the color becomes intensely red, but on adding more it disappears entirely, and can be restored by the addition of more of the sublimate.

17. One other way to make a milk-like liquid is to pour phosphate of soda into a solution of magnesium sulphate.

18. When a piece of silver is dissolved in nitric acid and some muriatic acid added, all the silver is precipitated, and the precipitate may be dissolved in ammonia, or a piece of zinc may be placed in it and acidified, when the silver will all be restored to the metallic state as a fine black powder.

We hope the above experiments will prove an amusement for many of our young readers; and when they become experts in exhibiting these "tricks of magic," as we might have called them, they will have also gained some knowledge of the methods employed by analytical chemists in testing for the common metals. Even practical men, who need sometimes to handle chemicals, will find that the above are reliable tests.

Another Trial of the Gatling Gun--One Hundred Thousand Rounds Fired.

The Navy Department, in order to determine the quality of the solid head metallic cartridges made by the United States Cartridge Company, Lowell, Mass., and to test the working powers and durability of the Gatling gun of $\frac{50}{100}$ inch caliber, ordered that one hundred thousand cartridges of $\frac{50}{100}$ caliber (containing United States service charge) be fired in the gun at Fort Madison, near Annapolis, Md. The trials commenced on October 23, and lasted parts of two days. On the first day (the 23d) over 30,000 rounds were fired; and on the 24th, 64,000 cartridges were fired, without stopping to clean the barrels; and after this unprecedented test, the gun (without the barrels being cleaned) was fired for accuracy at a target 12 × 12 feet, placed 300 yards from the gun; and out of 30 shots fired, 29 of the balls hit the central part of the target, striking point on and giving good penetration. It may be safely said that this number of discharges was never before made from any arm in the world.

Singular as it may appear, the fouling of the barrels did not increase after 4,000 or 5,000 rounds had been fired. The trials were made under the supervision of Lieutenant Commander J. D. Marvin, United States Navy, commandant of Fort Madison. Many distinguished navy and army officers were present at the trials. During a part of the trials, the gun was fired at the rate of over 400 shots per minute. A drum which supplied the cartridges to the gun, and which contained 400 cartridges, was frequently exhausted in from 50 to 55 seconds.

Of the cartridges used, none of the heads burst, none of the shells failed to extract, and there was only one missfire in about five thousand cartridges discharged. The cartridges are headed by a new process, which prevents injury to the fiber of the metal from compression.

AT THE recent meeting of the British Association, one of the ruled speculum plates of Professor Rutherford, of this city, 2,800 lines to the inch, was exhibited by Mr. Norman Lockyer, who stated that in the spectroscope it gave the same amount of dispersion as a train of twenty or thirty glass prisms. By its aid, movements of the sun's atmosphere as slow as five miles per second could be measured.