telescopes, namely, the "everlasting commingling of warmer and cooler portions of atmosphere between the object glass and object."

This atmospheric disturbance may be very much lessened by selecting a proper place for the observatory.

Professor Young finds the air at Sherman station, U. P. R. R., to be much clearer than at the Eastern seaboard, and those who have visited the parks of Colorado will remember the great brilliancy of their star light.

It is only necessary to immolate, in the interest of science, a sufficient number either of gentlemen of the Signal Service or volunteers, each on his mountain top, from Pike's Peak to the Himalayas, to find localities where Professor Tyndall himself could not object to the want of optical purity in the atmosphere.

The telescope being once established on its distant peak among the upper trade wind currents, and adjusted for photography, we may all look at once, by using ordinary and well known processes. Each photographic picture, as taken, is to be sent all over the world by copying telegraph, and published next morning in the newspapers. The operations are as follow:

1. A negative is taken, either with instantaneous or very short exposure, and either photo-lithographed, or copied by a gelatin relief print.

2. The print is electrotyped or pressed.

3. The electrotype is gradually cut away by the sharp pointer of a copying telegraph, and simultaneously engraved on a steel cylinder, by a similar machine at each receiving station. This cylinder may then be printed from, or treated as any other engraving.

The great accuracy of workmanship required for these relay engraving engines may be readily attained by milling machines with shaped diamond cutters. S. H. M., JR.

The Kromschroder Gas.

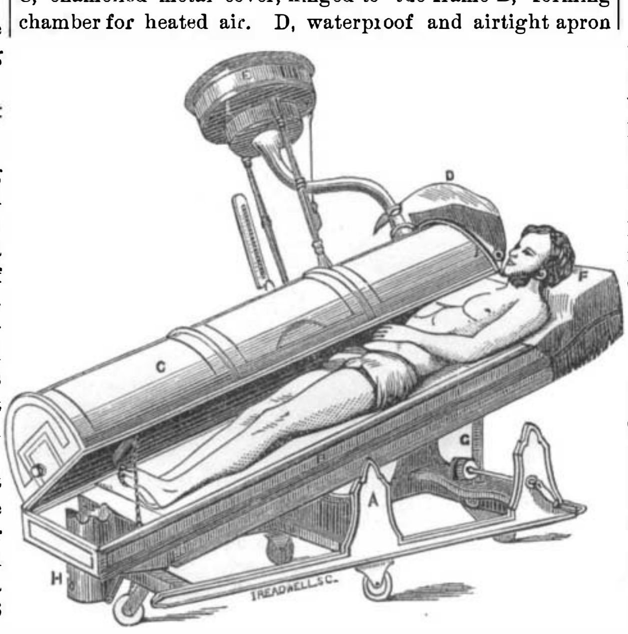
Several new methods of producing gas for illuminating purposes have of late been brought before the public, and among others is the process invented by Mr. Kromschröder. This consists in simply passing air through the vapor of a light hydrocarbon, the two combining and forming a gas of high illuminating power. The process has been in operation for about three months at Great Marlow, in Buckinghamshire, where we had the opportunity of examining it on Saturday last. The town of Great Marlow, however, has only been lighted regularly with the new gas for the past three weeks, its previous use having been intermittent and experimental, the ordinary coal gas having also been used. So successful, however, were these experimental trials that the Kromschröder gas is now regularly consumed, and the manufacture of coal gas is discontinued. The apparatus for the production of the gas is of a very simple character, and is erected in the gas works of the town. It consists of a sheet iron chamber 5 feet long, 4 feet wide, and 3 feet 6 inches high, the lower portion being 2 feet wider than the upper part for a hight of about 12 inches. In the upper chamber is placed a valve arrangement driven by clockwork and by which atmospheric air is forced into the lower or enlarged portion. Here it is made to pass through a mass of open fiberous material, the lower part of which is kept immersed in a liquid hydrocarbon. The air in its passage combines with the vapor of the hydrocarbon in the proportion of 70 parts of air to 30 of the vapor. In this condition the gas—for such it has now become—is conducted from the mingling chamber by a pipe into a receiver, capable of containing 100 cubic feet of the gas. As soon as this receiver is filled, its contents are discharged into the gas holder which was formerly used for the storage of coal gas, and which has a capacity of 6,000 feet. The reason for having the intermediate receiver is that the incorporating apparatus, although of ample power for producing the required quantity of gas, does not give sufficient pressure to lift the large holder, which is 30 feet in diameter. The time required to fill the large holder, or, in other words, to manufacture 6,000 feet of gas, is five hours. From the large holder the gas is supplied direct to the town, there being no purifiers or other apparatus required. The four main requirements in a gas for illuminating purposes are quality, cheapness, permanency, and capability of travel. As regards the first point, it was shown by photometric experiments that, with a burner consuming $3\frac{1}{2}$ feet per hour, a light equal to twenty candle gas was obtained, which is charged to consumers at 3s. 3d. per thousand feet, and this solves the second point. The permanency of this gas has been proved by allowing it to remain for three weeks in a holder subjected to the various temperatures, when a loss of 33 per cent was found to have been sustained. Lastly, it has been made to travel through $4\frac{1}{2}$ miles of pipes, and from its nature there is no doubt that it will travel any reasonable distance. The success of the gas is stated by its inventor to be due to the exact proportioning of the air and hydrocarbon vapor, a result he has only arrived at after several years of careful experimental research. Those proportions are, as already observed, 70 parts air to 30 of the vapor. To insure this result a hydrocarbon of constant specific gravity is used, that gravity being 6 70. Mr. William Bruff, C. E., is interesting himself in this invention, and it is from his experiments that the foregoing conclusions are deduced. The photometric experiments were witnessed and checked by ourselves. In the evening a drive round the town enabled a very satisfactory opinion to be formed of the gas as an illuminator, which opinion was strengthened by the use of the same gas at the hotel where the party of engineers and scientific gentlemen who had been inspecting the gas dined. Mr. Kromschröder, who explained the process of manufacture, observed that the gas is designed not so much to supersede coal gas in large towns as to afford a means of cheap gas light where coal gas could not be had. So far as the experiments go, the Kromschröder gas would seem well adapted to this purpose, and we wish its inventor success.—*Engineering.*

NEW TURKISH BATH.

The Turkish bath, as commonly practiced, consists in placing the patient in an apartment heated by stove or pipes to a temperature of 110° to 120°; in a short time, as soon as the pores begin to open, the patient passes into a still hotter chamber, where there is a temperature of from 150° to 210°. Here he remains until profuse perspiration is induced, and then, if he desires, enters a room heated still higher. He then passes into a wash room having a reduced temperature, is washed with warm water, then cooled with the spray bath; he then plunges into a swimming bath at the ordinary atmospheric temperature, which completes the ablutions.

The Turkish bath is a beautiful luxury and has but one discomfort, to wit, the highly heated atmosphere of the perspiring chambers. This is very oppressive to many persons; and to provide a portable bath as well as to overcome the difficulty just mentioned is the object of the present improvement, made public in the British *Medical Journal*:

A is the carriage upon which the bath rests, the wheels of which are so arranged that the whole apparatus can be turned completely round in a space little more than its own length. B, the frame and spring mattrasses fitted with centers to the carriage A, and forming the bottom of bath. C, enamelled metal cover, hinged to the frame B, forming chamber for heated air. D, waterproof and airtight apron



to prevent escape of heated air at the top of the bath. E, cistern for shower bath. F, pillow, with hinged head board to turn up when the bath is not in use. G, rack and pinion for raising or lowering the bath to the level of a bed, for use of an invalid. H, heating apparatus.

This invention is designed to supply to the public a portable Turkish bath in a complete and simple form. The advantages of the patent over the ordinary public Turkish bath are these: The heat can be raised in less than ten minutes to 180° Fah., and to the full temperature of 220° Fah. in fifteen minutes. The heat is obtained from gas, spirit, or other suitable means; it is under perfect control, and can be maintained at any degree, up to 220 Fah., that may be required. A shower bath is attached, by means of which a copious discharge of tepid or cold water can be obtained, suddenly or gradually, at the pleasure of the bather or attendant.

The head may, if required, be kept out of the bath in cool air. The bath offers in this respect one of the advantages of the sand bath, in which the entire body, with the exception of the head, is covered. It is probable that the therapeutic effects of the bath, with and without the exposure of the head to the heated air, may be very different.

Heating Power of Different Fuels.

A practical method of determining the heating power of fuel has recently been given by E. Seidler in the *Zeitschrift für Zucker Industrie.* The object is attained by first drying some 100 lbs. of the fuel at 1,000°, and noting the loss in weight; then by burning a measured amount, 2,000 lbs. for instance, weighing the ashes and cinders, and, after allowing $\frac{1}{4}$ per cent for ashes carried off by the draft, calculating the amount of combustible in the fuel; for example, supposing the fuel was found to stand as follows: Water, 40·75 per cent; ashes and cinders, 17·0 per cent; ashes carried off by draft, ·25; total, 58·0 per cent, leaving 42 per cent of combustible in the fuel; 2 per cent may be subtracted from the percentage of ashes and cinders for the coal which falls between the bars of the grate. For peat, multiply the percentage of combustible thus formed by the factor 7, and deduct from that the percentage of water in the fuel, to arrive at the amount of water in pounds which will be evaporated by one pound of the fuel; for example, in the above case, $0·42 \times 7 = 2·94$, which —0 4075 $= 2·5325$. A ton of such fuel then will evaporate $2000 \times 2·5325 = 5065$ lbs. water at 0°, deve'oping $5065 \times 640 = 3{,}241{,}600$ heat units. If the water used is run into the boiler at a higher temperature, 20° for example, the amount that can be evaporated by one tun is

$$\frac{3{,}241{,}600}{620} = 5228 \text{ lbs.}$$

EN ROUTE TO THE GREAT EXPOSITION.—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 2.—Continued

LONDON, JUNE 10, 1873.

The day in Glasgow afforded time to visit the great shipbuilding establishment where Randolph and Elder did so much toward the introduction of the "compound" engine and of iron ships, and to see the University of Glasgow where James Watt worked as a repairer of instruments, and where he made himself a name more enviable than was ever won by the sword, and not less enduring.

GLASGOW UNIVERSITY

has just been driven from the old structure which has so great historical interest, and is just becoming reëstablished in a noble pile of buildings at the summit of a high hill at the extremity of a beautiful park, at the west end of the city, where its surroundings are quite in keeping with the architectural beauty of the edifice itself. The new university buildings will, when completed, have cost about one and a half millions of dollars. Something more than one half the sum was contributed by the public spirited citizens of Glasgow. The floor space amounts to about six acres. The buildings are as convenient in their interior arrangements as they are beautiful on the exterior, and the visitor is compelled to admire alike the intelligence which has sustained and encouraged the growth of this noble institution and that which conducts its academic course. (We published an engraving of this structure on page 179 of our volume XXVII.)

The old model of the Newcomen steam engine, which, when sent to Watt for repair, first attracted his attention to the defects of then existing machines for applying the power of steam, and prompted him to make the intelligent investigations which led him to its improvement, is carefully preserved here; and we stood by it a long time, examining with interest its every part, and enjoying, with rarely equalled pleasure, the many historical associations which it brought to mind. We were pleased to learn that nothing, among the large and interesting collections of the University, attracts more attention from visitors than this battered and discolored old model.

THE LATE PROFESSOR RANKINE.

The University has met with a serious loss during the past year in the death of Professor Rankine, who will be ever remembered as one who, at the time of his death, had done more than had ever been done before in the application of science to practical investigations, and, particularly, as the first to give practical shape to the known scientific principles involved in the construction of steam and other heat engines, and in naval architecture. The city of Glasgow should build a monument to his memory, nobler than any of those which now adorn St. George's Square.

SHIPBUILDING ON THE CLYDE.

In our journey to and from Govan—the village just below the city, in which the shipbuilding establishment of Elder & Co. is situated—we counted some fifty iron steamers, in all stages of construction, and probably one third more might be laid down in the yards. Business has been severely checked by the recent rise in price of stock and labor, in consequence of strikes here and in the iron and coal producing districts. Very little new work is projected, and the consequences of the movement seem likely to be a serious loss of trade and much consequent suffering among the working people who are daily being thrown out of work. Iron which, a year ago, was worth fifty or fifty-five shillings a tun to-day costs a hundred, and all other expenses have risen greatly, and sometimes proportionally. Contracts are therefore made elsewhere, and Glasgow workmen must suffer at home, or must emigrate to some busier spot, unless a change for the better takes place here.

Elder & Co. now employ some 2,500 men, and have facilities for employing 6,000 or more. They are building seven or eight ships, and have room to lay down a half dozen more. Their new engine shop is one of the finest in the world, and is splendidly arranged for their work. Traveling cranes, radial drills, steam riveting machines, and very large planing and slotting machines are well placed, and small tools in considerable variety, but not equally creditable in design and construction, are placed out of the way on lofts, above the larger tools.

This firm began many years ago the construction of the compound engine, and were among the very first to make it a specialty. They were a long time pushing it into use, but the introduction of surface condensation in sea going vessels, and the gradual rise of steam pressure which succeeded, enabled them to exhibit more and more convincingly the economical superiority of that plan, and they are now reaping the harvest which they fully deserve. They do more work by far than any other firm on the Clyde.

A large amount of capital is invested in Glasgow in other branches of industry, one of the most important being the manufacture of chemicals. Her manufactures and her commerce have, together, produced rapid growth in wealth and population. The city now contains nearly 600,000 people.

"See what a change trade's golden wand can do!
As if by magic, make a village spring
To all the glories of a capital."

We were able to spend a few hours in Edinburgh, and there visited the old castle, the history of which is so familiar to every school boy. Thence we came to London by night train. It was by no means a comfortable ride, for the managers of the road have not yet exhibited a very strong desire to make their patrons comfortable, and have not introduced sleeping cars. R. H. T.