PETROLEUM AS FUEL.

Report to the Trustees of the Petroleum Light Company, by Col. JULIUS W. ADAMS, Engineer, of experiments made at the Morgan Iron Works, New York, Oct. 11, 1865.

ENGINEER'S OFFICE, NO. 128 BROADWAY, NEW YORK, October 15, 1865.

GENTLEMEN:—By your direction experiments have been in progress for some months having in view the elucidation of the principles and methods used by Mr. Simon Stevens for burning petroleum and other hydrocarbons in combination with jets of steam, which method, and the apparatus used, form the basis of the various patents held by your Company in this country and in England.

The difficulty hitherto has been in attempting to burn the crude petroleum, that the imperfect combustion alone attainable by the means in use, has resulted in great waste of the material, as shown by the dense smoke which invariably accompanied all attempts to burn it in a confined space. This and the difficulty of regulating the feed, have hitherto prevented a successful application of this material as a fuel in the generation of steam in boilers. I am well aware that it has occasionally been accomplished on a small scale, but no experiments, that I have knowledge of, have exhibited anything like the requisite command of the material in feeding the fire, or certainty in its use as a fuel. This remark is made in full knowledge of what has been accomplished in this direction by Messrs. Linton & Shaw, as well as by Mr. Richardson in England. This difficulty has, I think, been successfully overcome in the experiments conducted for your Company, and the crude petroleum, without other fuel than the chips for kindling the fires, has been burnt daily under a marine boiler, in a course of experiments extending from the month of May last, and proves more manageable, more under the control of the fireman, and develops an amount of heat greater than any fuel with which we are acquainted.

Mr. George W. Quintard, of the Morgan Iron Works, having offered us the use of a marine boiler for our experiments, we applied our apparatus to it, without regard to any disproportions which might exist between the two; further experiments being needed in order to determine their precise relative dimensions. The experiments thus far have not extended beyond the determination of the fact that petroleum may be used with great facility as a fuel under steam boilers, by a single fireman of ordinary intelligence. No minute analysis has been made of its comparative economy—the results thus far being regarded as merely general; but from the results herewith shown you will be enabled to determine how far our experiments sustain the claim we have advanced of having successfully applied this material to steam boilers.

The boiler used was an internal flue and return fire tube boiler, the shell measuring thirteen feet and nine inches in length, by six feet in diameter, with a grate surface of thirty-five square feet; contents about fifteen hundred gallons of water to the level of six inches above the upper line of tubes. There were three flues in the boiler, the center one, P, of 16 inches diameter, and the other two, R, 12 inches diameter. The boiler was not set as represented in Figs. 1, 2 and 3, which is the method recommended; but rested merely on three walls of the dimensions of the furnace walls. There were five rows of 2½-inch fire tubes, as shown in Fig. 2, being 75 tubes in all; the back connection being 15 inches by 3 feet 5 inches, and the smoke stack 30 inches in diameter. The boiler was unclothed. Fig. 1 represents the plan of the furnace, showing the arrangements of the retort or mixer, and the oil and steam tubes. Fig. 2 is a cross section of the boiler through the furnace, and Fig. 3 is a longitudinal section through the center of the boiler and furnace. The same letters refer to the same parts in the several figures.

REFERENCES.

A. Coil of Pipe from the Oil Reservoir.
B. Retort or Mixer.
C. Short Connecting Pipe.
D. Pipe leading to Oil Reservoir.
F. Burners, 90 in number, 1-16th inch each.
G. Steam Pipe.
K & H. Steam Valves.
M. Oil Valve.
N. Tubes into which are screwed the Burners.
P. Large Flue of Boiler.
R R. Smaller Flues of Boiler.

Fig. 1.

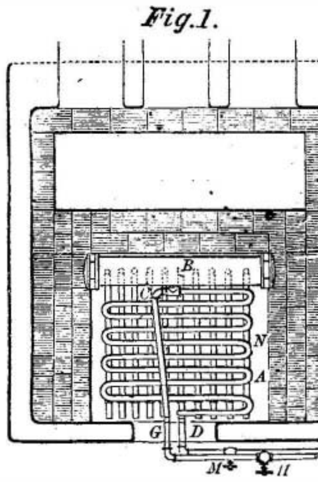
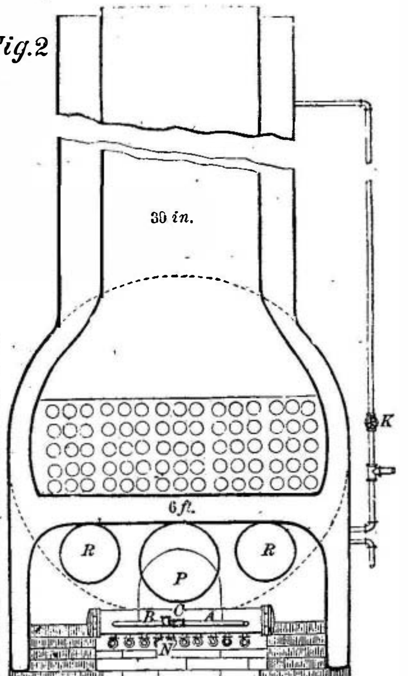
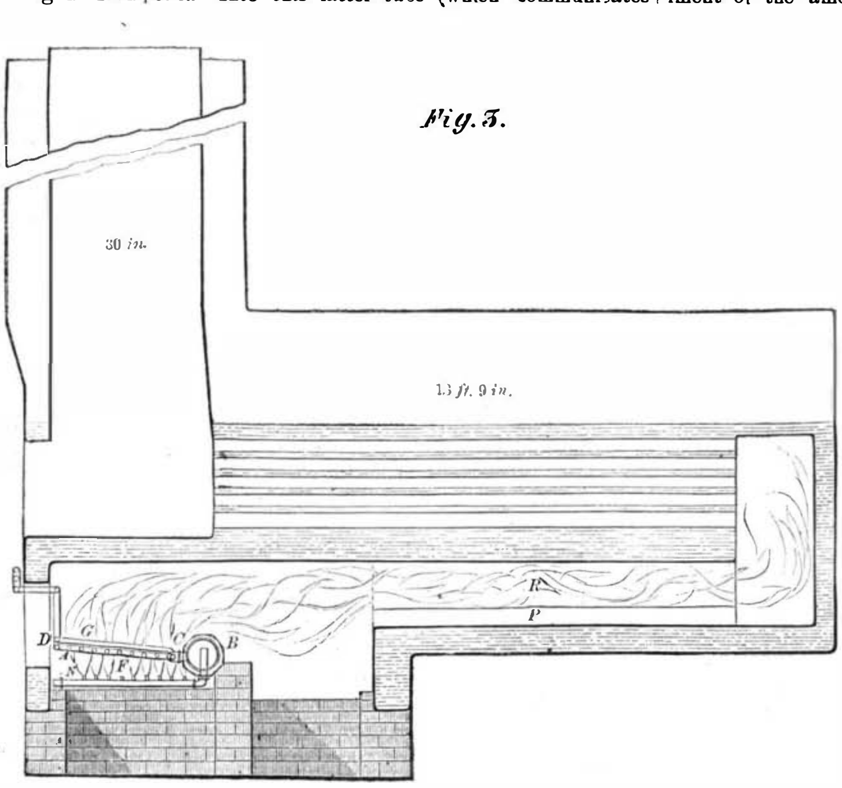


Fig. 2



The fire bars were removed, and in their place a coil of three-quarter inch wrought-iron pipe, A, was inserted, the total length of pipe in the coil being 23 feet; at the back, directly across the furnace, a wrought-iron tube, B, or retort, five inches in diameter, and closed at both ends, was placed, with a short tube, C, of two inches diameter immediately in front of it. Into this latter tube (which communicates with the retort) one end of the coil is inserted, and the other end, D, passing out of the furnace door, communicates with the reservoir of oil, being in this case the cask in which it was brought to market. The flow of oil is regulated by a stop cock, M, placed near the furnace door. Some eight inches under the coil of pipe lie ten one-inch wrought-iron tubes, N, closed at one end, the other end inserted into the retort—these tubes lie parallel to each other, and are two feet three inches in length, and into each of them is tapped nine cast-iron burners, F, with one-sixteenth inch opening, making in all ninety burners. An inch above the plane of the coil, a wrought-iron pipe, G, proceeds direct from the short tube in front of the retort into which the coil is inserted, to the furnace door, and thence to the steam space of a small auxiliary boiler; a branch, with proper valves, K, connects this pipe with the steam space of the main boiler—the flow of steam being also regulated by a stop cock, H, placed in the vicinity of the furnace door, near the oil cock.

Fig. 3.



The water in the boiler being cold (sixty degrees), at fifteen minutes past two P.M. some billets of wood and shavings, weighing about 12 pounds, being placed upon the coil, near the furnace door, were lighted and the door partially closed; after an interval of 15 minutes the oil cock, M, was gradually opened, which permitted a flow of oil from the reservoir through the coil; simultaneous with which, or a little later, the steam cock, H, was opened, which conveyed steam of about 20 pounds pressure from the auxiliary boiler, through the heated steam pipe, G, above the coil, to the retort or mixer, B, where, combining with the vapor of oil from the coil, it passes into the straight pipes, N, under the coil, and is fired at the burners, F. The flame was vivid and intense, regulated in its force by the relative flow of oil and steam, and was entirely under the control of the fireman, who, at his pleasure, could reduce the flame to the flicker of an expiring lamp, or extend it by a single movement to a volume filling the large flues and furnace with its flame. No smoke or unpleasant smell was perceptible, and the combustion was complete and entirely manageable. Steam, at atmospheric pressure, was raised in the boiler in 29 minutes from the time of admission of oil into the coil. No measure was taken in this experiment of the amount of water evaporated, the apparatus not being considered as properly proportioned to exhibit the economical value of the fuel; and the experiment terminated in about one hour by closing the oil cock, M, and the fire was put out.

The analysis of this experiment may be shown as follows: As this experiment only exhibited the weight of oil which, consumed under the boiler, raised a given quantity of water from a given temperature of 60° to the boiling point, it is requisite for a comparison with the known effects of anthracite coal, to show the proportionate amount of oil which would be necessary to convert this same bulk of water into steam of the atmospheric pressure, or the weight of water which a pound of this fuel will convert into steam. According to Tredgold, the quantity of fuel which will convert a cubic foot of water, of a given temperature, into steam, at the pressure of the atmosphere, is obtained by multiplying the quantity of fuel which will heat a cubic foot of water one degree, by some of the latent heat of steam, and the difference between 212 degrees and the given temperature of the water. In this case, 212°—60°= 152°. The latent heat of steam, according to Dr. Ure, is 967 deg., which, added to 152 deg.=1,119 deg, which, multiplied by the quantity of fuel which will heat a cubic foot of water one degree, will give the weight of fuel requisite to convert a cubic foot of water from the temperature of 60° into steam. This product multiplied by the number of cubic feet of water to be converted into steam, will give the total amount of fuel required in this case.

Making the proper allowance for the pine wood in lighting the fires, the weight of oil consumed in the experiment was 60 lbs.; the contents of the boiler was 200 cubic feet, at a temperature of 60°, which was heated by this weight of oil to the boiling point =212°; thus the weight of oil which heated 200 cubic feet one degree was $\frac{60\text{lbs}}{152}$=0·39 lbs; and the weight of oil which was requisite to heat *one* cubic foot of water *one* degree was $\frac{.39}{200}$=.0019 lbs. This multiplied by 1,119°=2·126, and this by the 200 cubic feet of water in the boiler, gives 425 lbs. as *the weight of the oil which would convert the contents of the boiler into steam at the atmospheric pressure*—or $\frac{200 \times 62.34}{425}$=29·34 lbs., as the *weight* of water at a temperature of 60°, which will be converted into steam by *one pound of oil.* From Isherwood's valuable experiments, on marine boilers—we find this same type of boiler in use on board the U. S. Steamers—and from the mean of the experiments conducted on these boilers, we find the quantity of water evaporated, from a temperature of 100° with steam at the pressure of the atmosphere, by one pound of anthracite coal, to be 8·5 pounds. To compare this with the evaporation made from a lower temperature of water by means of the oil, this weight must be reduced in the following ratio, established by Isherwood: $\frac{966.6+111.28}{966.6+151.36}=\frac{1078}{1118}$=0·964, which multiplied by 8·5, gives 8·16 as the weight of water at 60°, converted into steam of atmospheric pressure by one pound of anthracite coal.

Comparing this result with that above shown for the product of the combustion of oil, we find the evaporating power of the two fuels to be in favor of the oil, in the ratio of 29·33 to 8·16, or 3·6, weight for weight; the coal and the oil occupying about the same space for a given weight. That is to say, a cubic foot of coal as stored aboard ship, will weigh about the same, or a little less, than a cubic foot of oil, the first weighing from 48 to 52 pounds, and the latter about 54 lbs. to the cubic foot.

Further experiment, with improved apparatus, will be necessary in order to determine the precise economic value of this fuel in comparison with coal, but the advantages of the oil as a fuel for marine engines may be briefly summed up as follows:—

Rapidity with which steam may be raised—reduced dimensions of boiler and furnace below that required for coal—the continuous firing effected by feeding the fuel through a pipe into the furnace, thereby preventing the great loss of heat in the furnace every time a fresh supply of coal is thrown on, and the rush of cold air upon the opening of the furnace doors —the freedom from smoke, cinder, ash, or refuse of any kind, which in coal reaches from seven to over sixteen per cent of the whole amount. In the ability to command a forced fire almost instantly, without a forced draught, which, under some circumstances at sea, is of vital importance. In dispensing with the numerous class of coal heavers, stokers, etc., and all the inconvenience of raising clinkers and ash from the furnace rooms; and finally the diminished space occupied in the storage of the fuel.

Respectfully submitted,

JULIUS W. ADAMS, Engineer.

The above experiments were made in presence of Capt. Bythesea, R. N., Sec'y. of Her Brit. Maj. Legation at Washington; Cyrus W. Field, Esq., Hon. James Wadsworth, Hon. Horace Greeley, Hon. David Dudley Field, John E. Williams, Esq., President Metropolitan Bank; William A. Thompson, Esq., Vice-President Erie and Niagara Railway; Geo. W. Quintard, Esq., Morgan Iron Works; Mr. James Farron, Superintendent Morgan Iron Works, and officers of the Company.

AS ONE of the workmen employed at Whitewell's Blast Furnace, South Stockton, was recently taking a slag ball from the furnace, a tipper named Henry Badley, was about to tip it when it burst, and the molten slag flew over him, setting his clothes on fire, burning him severely on various parts of the body, and melting his watch.

THERE will be but one eclipse this year that will be visible to us—a total eclipse of the moon, March, 30th.

THE FOOT LATHE.

Number 8.

[Continued from Page 66.]

An indispensable article on a foot lathe, where any fancy work is to be done, is the centers—of which we have before spoken—shown in Fig. 40. These consist of a common set of heads, with spindles fitted to them. One spindle has an index plate and spring, and the other has a common center. These heads set on a slide that is moved back and forth over a rest, screwed to the lathe bed as usual. It is easy to see that with this we can do some very fine cabinet work. Suppose we have a round vase turned up handsomely, and we wish to flute the base or make it a series of curves all round; to do this we have only to put it in the centers, set the index so as to come out even, as before explained, and go ahead.

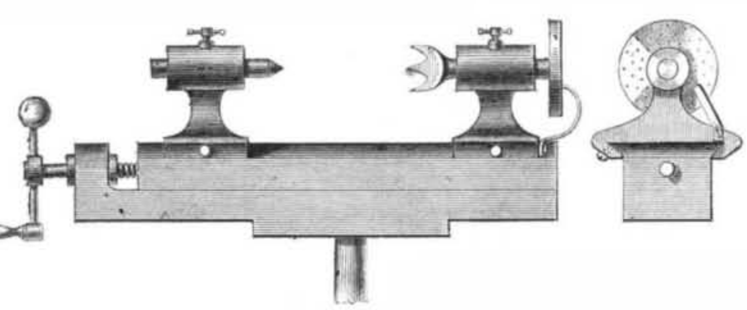


Fig. 40.

The kind of cutter to be used is a sort of gouge set in a cast iron head, something as a plane iron is set in its stock. That is, fitted tight to a groove and held by a set screw. Two of these cutters should be used at equal distances apart, and the cutter head should be keyed on a short shaft set between the main centers of the lathe. The whole should be accurately balanced, or else the work will be full of chatters or ridges. Since centrifugal force increases as the square of the velocity, any thing that runs a little out of truth will be very much exaggerated as the speed increases. By using cutters of different shapes, beautiful effects can be produced; as, for instance, suppose we take a common round-nose cutter, set the index so as to divide the circle of the job we are to work on in twenty-four parts, and execute that part of the design, then take a tool forming an ogee and work out the spaces intervening, we shall find that the article, when completed, will have a beautiful appearance, and that instead of being round the bottom will be octagonal, which will present a pleasing contrast to the rest.

The centers can be set at any angle with the cutter shaft, and a pineapple pattern can be made on straight surfaces by executing one part at one angle, then reversing the rest that carries the centers, and finish the remainder, one part of the pattern crossing the other.

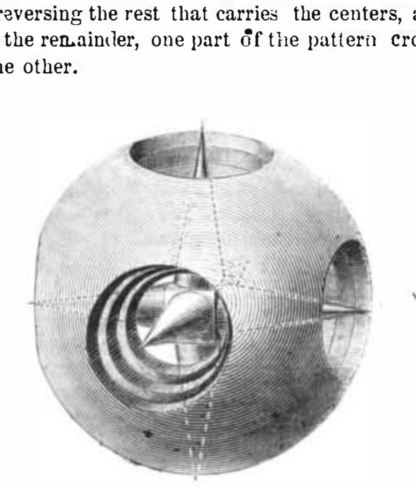
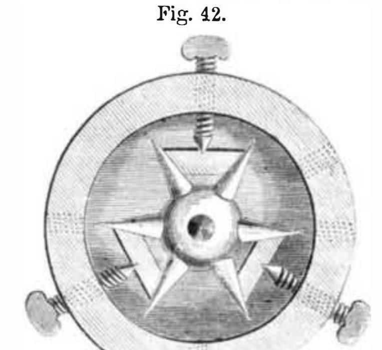


Fig. 41.

We present herewith views of a novel ornament which exhibits great mechanical ingenuity and manual dexterity, but is otherwise of no value. It consists, in one form, of a globe with a series of rings or globes inside, and a six-armed spur projecting through holes—all cut out of one solid piece.

This figure shows how the points are turned. After the internal rings are cut out with a quadrant tool like Fig. 43, and the spur also severed, by cutting in the ends of the holes (not boring them out solid), the globe is put in a shell chuck with three set

Fig. 42.



screws in it, as shown. The set screws go through the holes in the globe, and the cross pieces in between the spurs serve to steady the job. Any number of points may be turned in the globe. Fig. 44 shows a polygon with many spurs turned inside. At first sight it would appear that the tool severing the rings would cut off the points also, but it will be seen that this is not the case, for the holes being bored so as to leave a core standing (which afterward serves to

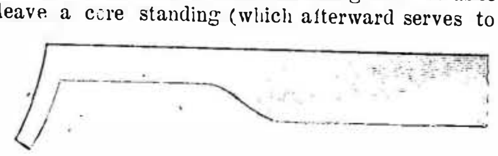


Fig. 43.

make the points of the spur), the severing tool falls into the holes and goes no further, and each division serves as a guide for the tool in the next hole, so that the globe is made the same size, without jags. The quadrant tool, shown before, must be followed round

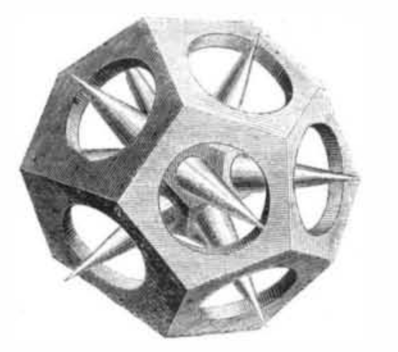


Fig. 44.

the shell in the act of cutting it out, so that it will make the same round, and the globe must be shifted in the chuck to reach all the holes. It is no easy task to make this little affair, for all it looks so simple.

ARRANGEMENTS have been made with Mr. G. W. Beardslee for the purchase by the Government of the torpedo implements used by him in destroying vessels of war, harbor obstructions, forts, and batteries, etc., by means of submarine explosions. Mr. Beardslee has recently been occupied at Chatham in making the preliminary arrangements for some futher additional experiments on a much more extended scale than any previously undertaken, with the object of further demonstrating the importance of the new agency for the destruction of forts and vessels of war.

MR. G. W. CUSHING, master mechanic of the Chicago and North-western Railway, has sent us a spirited colored photograph of locomotive designed by him for the company, for which we return thanks.

THE application from the artisans employed in the different dockyards for an increase of wages, has been refused by the English Admiralty.