Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, JANUARY 21, 1882.

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(Illustrated articles are marked with an asterisk.)

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For the Week ending January 21, 1882.

Price 10 cents. For sale by all newsdealers.

THE USE AND ECONOMY OF GAS ENGINES.

A secondary, but important and instructive feature of the recent exhibition of electricity in Paris, was a notable display of gas engines, a type of engines in increasing demand for driving dynamo-electric machinery.

This is not the only way in which the use of electricity for illumination tends to increase the consumption of gas, thus making those apparent rivals, gas and electricity, in reality mutually helpful allies. One of the first effects of the introduction of electric light is to accustom the public to a much greater brightness of artificial illumination than had before been thought necessary. Where one burner was formerly sufficient two or three are now required, so that the demand for gas is directly increased by the development of electric lighting. And even though electric lights should, in the end, very largely displace gas lights, the employment of gas engines for running the machinery of electric lighting is likely to create a larger demand for gas than now obtains; and the use of gas as a source of power cannot well be stopped with the running of dynamo-electric machines. The increasing attention drawn to the efficiency and economy of gas engines promises not only a very large increase in the commercial manufacture of gas, but as marked a change in the use of coal as a source of power.

It is well known that as coal is burned for the generation of steam power, there are two inevitable sources of loss, and great loss. So much of the energy developed by combustion is used up in converting the water into steam that a theoretically perfect engine could not utilize more than one-fifth the total energy of the coal. In practice the efficiency of the best large engines is only half that of a theoretically perfect engine, or about one-tenth the power of the coal. With small engines and ordinary furnaces the efficiency falls much lower.

The ordinary furnace, moreover, is ill adapted for the economical execution of the two distinct processes which go on in them, namely, the conversion of coal into gas, and the simultaneous combustion of the gas as fuel. When these processes are separated, and the gas properly made and economically burned, it may be possible to approach somewhat more nearly the theoretical efficiency of the perfect steam engine; but, at the best, improvement in this direction promises less in the way of increased economy than is secured by the direct development of power in gas engines by the burning of gas explosively.

As shown by Prof. Ayrton, in his address at the Electrical Exhibition (SCIENTIFIC AMERICAN SUPPLEMENT, No. 316), the theoretical efficiency of a gas engine should be about 75 per cent, if loss of heat by conduction, radiation, convection, and friction could be prevented; this against an efficiency of 20 per cent with a theoretically perfect steam engine. Prof. Ayrton goes on to show, mathematically, from the laws of thermo-dynamics, that the *practical* efficiency of a gas engine should exceed 50 per cent, or five times that of a steam engine.

Touching the relative economy of working the two types of engines in practice no entirely satisfactory comparison can be made, since no very large gas engines have been constructed, and small gas engines are not so disadvantageous in comparison with large ones as small steam engines are. Professor Ayrton's tables show, however, the comparative working cost of a portable steam engine and an Otto gas engine, each of 30 horse power, for 300 working days, the one using (bituminous) coal at $3.75 a ton, the other coal gas at 75 cents a thousand cubic feet. The results show that the cost of running the gas engine was considerably less than that of the steam engine, notwithstanding the higher cost of the fuel.

A much greater working economy was developed when the gas engine was run with a cheap gas made by the Dowson process. In this case the gas for 300 days' running was made from 39 tons of anthracite worth $5 a ton. To run the steam engine 300 days required (including 10 tons of coal consumed before and after work) 227 tons of coal. Taking all the items of expense into the calculation (labor, repairs, interest, etc., the coal being reckoned at $3.75 a ton), Professor Ayrton found the economy in working cost in favor of the gas engine using Dowson gas, compared with steam, to be 47½ per cent. The economy in working cost in favor of Dowson gas, compared with coal gas, was 45½ per cent. The saving in weight of coal in favor of Dowson gas and gas engine, compared with steam engine requiring 6 pounds of coal per indicated horse power, was as 217 tons to 39 tons, or (as he figures it) 88 per cent.

Obviously a liberal deduction must be made from these percentages to get a just comparison of the weights of coal required where the steam is generated under fairly economical conditions, the allowance of six pounds of coal per horse power per hour being two or three times what is required with good stationary or marine engines. On the other hand, to adapt the comparison to this market there would be a decided gain in favor of gas (by the Dowson process) owing to the relatively greater cheapness of anthracite in this country. The other factors of Professor Ayrton's calculations being the same, the economy in favor of Dowson gas, made from anthracite at the price of such coal here, would be over fifty per cent. In case the gas were manufactured at the coal mine (where coal is cheap and finely broken coal suitable for gas making is a nuisance) and the gas piped to the point of consumption as is now contemplated, the relative economy of gas engines would be still greater. In any case the problems raised and economies promised by the extension of this method of generating power are well worthy of the attention of mechanical engineers and inventors.

The saving in bulk and weight of coal, in case gas engines should prove to be suitable for marine use, is a matter of great importance where space and floating capacity are so valuable as they are at sea; and the indications are that the apparatus required for manufacturing gas to be used explosively would be much lighter and less bulky than the furnaces and boilers needed for generating steam by the combustion of two or three times as much coal as would suffice for a gas engine of equal power.

OUR LEATHER INDUSTRY.

The illustrated article upon the sole leather manufacture we this week publish—forming No. 81 in our series on American industries—can hardly fail to be of general interest in this country, both in and out of the trade, while it is sure to receive marked consideration in many other parts of the world, where our leather and the processes of manufacture have been conspicuously misrepresented ever since we began to be large exporters in this line, about ten years ago. In 1870 our total exports of leather were but $111,077; in 1876 they reached the sum of $9,343,560. Their aggregate value has fallen off a little since then, because prices are lower, but there has been an actual increase in the quantity of goods shipped, and the market for American sole leather in England, in the north of Europe, and on the Mediterranean, is now as well established as is the demand for our grain and provisions. Germany, in answer to the urgent appeals of her tanners, placed heavy duties on our sole leather in 1878. The tanners there said they would all be ruined if this were not done, and held conventions in many places, finally compelling the Reichstag to impose the duties; but a good deal of our leather still goes there nevertheless, and our trade with the rest of the continent has increased more than enough to make up for the small decrease in the German shipments. In France the duty has always been practically prohibitive, but in both France and Germany they would be glad to allow our sole leather to enter free of duty if we would but put them on the same basis in regard to their trade here in finished calf and kid skins.

In these goods, though our own productions for actual wear will compare favorably with those imported, much of the finest stock used is made in France and Germany, our receipts thereof, for the past ten years, having averaged about $5,000,000 a year, while for the ten months to the first of last November they were $5,874,505. Such goods require nice selections and careful assorting in the raw stock, more thorough working by hand, and more particular attention in many minor details than have been found could be done with profit here, notwithstanding the duty. They require but little bark to tan, and a great deal of labor in finishing, conditions which are practically reversed in the sole leather manufacture.

Whether or not we regard tanning as a distinctively chemical process, it is conceded that the value of all sole leather is primarily dependent upon the permanence of the combination of tannin with the gelatin of the hide. With no other tanning agents yet discovered can so positive and fixed a union be effected as is possible with the tanning solutions obtained from oak and hemlock bark. These materials are as yet cheap and abundant here, and will be so for at least a generation or two to come, from the supplies afforded by our virgin forests, while in Europe similar tanning agents are to be had only in limited supply, at four to five times the cost. This explains why we have now a large and steady trade in the export of hemlock sole leather. We did not do much in this line for many years after we commenced tanning with hemlock bark, principally because of foreign prejudice against the red color of the leather made with it, English tanners claiming that it was not tanned, but only colored raw hide. Now, however, they appreciate its excellent qualities, its capabilities for resisting water and withstanding wear by attrition, in the soles of boots and shoes, as quite equal to those of the best English sole leather, and greatly superior to the leather of their "mixed" tannages, or the generally poor sole leather made on the continent of Europe. The English boot and shoe manufacturers are now, in consequence, as steady customers for our hemlock sole leather as are all the large manufacturers of standard grades of work in our own country. This red sole leather goes into the bottoms of nearly all the boots and shoes they make for export to all quarters of the world, so that it is probable this one product of American industry finds in this way a wider market than anything else we make in every quarter of the globe. The strong prejudice which existed against it for many years is being everywhere overcome by a better acquaintance with its actual good wearing qualities; and the description we elsewhere give of one of the great tanneries where such leather is made—the largest sole leather tannery in the world—cannot fail to aid materially in extending sound practical ideas in relation thereto.

A Large Steel Sailing Ship.

What is described as the largest steel sailing ship afloat was lately launched at Belfast, Ireland. It registers 2,220 tons, and has been named the Garfield. It will be employed in the Australian and California trade by the managers of the White Star Line.