brief as it is, warrants the statement that the dividends of to-day are declared from the wastes of yesterday; and the knowledge of it seems to touch, in the mind of the gas engineer, whenever by chance he happens to gaze at the chimney of an electric lighting company, a sort of sympathetic chord in harmony with the feelings of the stockholders thereof, in the shape of a vision of dividends vanishing in smoke, worse than wasted, because an intolerable nuisance.

Important as the mechanical evolution of the industry has been, it fairly sinks into insignificance in comparison with what has been accomplished and with the possibilities in view, in the evolution of the business end of the industry, following the line of enlarged output at lower prices.

Progress seems to be the watchword in all the lines of industry in the present age, and our electrical friends just at present are unusually active. Among the many startling announcements of recent date in reference to progress in electric lighting probably none seems so tangible, and has attracted so widespread attention in the scientific press, as the discovery of Dr. W. W. Jacques, of Newton, Mass., of a chemical process by which electricity can be generated direct from coal. So radical are the changes in the production of electricity by this method that a writer proclaims that "dynamos will be sent to the attics, and it will be cheaper to heat and work by electricity than by fires." And similarly we find in other magazines page after page of interesting scientific enthusiasm pertaining to this particular invention, until we are constrained to give it a careful and impartial examination. The process may be briefly described as follows: Iron retorts are set up on end in a furnace. The retorts are partially filled with caustic soda. They also contain a piece of carbon suspended from the top, and are provided with an air supply at the bottom. The furnace and contents are to be brought up to a temperature of 400 to 500° Centigrade, and a supply of air forced up through the fused mass of soda, the oxygen from which attacks the carbon and forms electrical energy, with which arc and incandescent lights can be immediately maintained. The efficiency is said to be such that thirty 16-candle incandescent lights were maintained for nearly nineteen hours with a consumption of only eight pounds of carbon in the retort; and this is pronounced an efficiency of about ninety per cent., for the eight pounds of carbon consumed in the retort. But what about the perhaps eighty pounds of carbon consumed outside of the retort to maintain this temperature of 800 to 900 degrees Fahrenheit and the air-blast for the nineteen hours? So disposed are enthusiasts in science to exalt any new thing that this, probably the real source of the energy, is passed over in comparative silence. If we call an enthusiast's attention to this, we are told that they are on the track, and the next step will be to accomplish all of this without the aid of outside heat; which brings up the suggestion: suppose you could do this without the aid of outside heat, or, what is more probable, suppose a small portion of the energy generated—say not to exceed ten per cent. of it—could be diverted to maintain this heat and pump the air. "Then," the enthusiast exclaims, "we would move the earth, we would certainly revolutionize all existing things." "But what about the carbon consumed in the retort?" suggests the practical man. Could you not manage in some way to furnish this, or a large portion of it, without cost? And, if you could, suppose we compare the efficiency which you would then attain with the efficiency of the modern gas works. They have the retorts set in the furnace. They are charged with carbon in the form of coal. According to scientific authorities, something more than twenty per cent. of the energy is driven off in the form of carburetted hydrogen, called gas, which can be safely and easily stored without loss or deterioration for any length of time; and the practical man claims that the other eighty per cent. is retained as follows: forty per cent. in the form of coke, twenty-five per cent. in the form of tar, and fifteen per cent. in the form of ammonia.

One-fourth of the coke, or ten per cent. of the entire amount of energy, suffices to do all the work of heating the furnaces, and the balance of these residuals, in many cases, sells for enough to pay for all the coal, and on an average, should pay for about eighty per cent. of it.* But the scientist comes forward with an array of heat units and standard candles to prove that eighty per cent. of the energy does not remain in form of the above-named residuals, and the practical man waves him aside with the exclamation that they pay eighty per cent. of the coal bill, and that the energy which pays the bills is the right kind of energy for him; and he claims that, if he can eliminate eighty per cent. of the raw material by the sale of residuals, then he has a right to consider the entire production of the original article sought as the production of the remaining twenty per cent. of the raw material, which would show an efficiency of the full one hundred per cent. of energy. And then he calls attention to the wonderfully efficient character of this energy when utilized with the oxygen of the atmosphere through bunsen burners, incandescent lamps, and gas engines for heating, illuminating, and power purposes.

The gas engineer calls on nature twice during the carbonizing of his coal for assistance from the oxygen of the atmosphere, as has been shown under the description of the regenerative furnace; he calls again for assistance in the distribution of his product under the weight of the atmosphere, which does it quietly and effectively, unseen and unknown to most of us; and he calls again at the utilization of the product for a supply of oxygen to support its combustion, for all its various purposes of light, heat, and power, calling twice in the use of the Welsbach lamp, or for a double service, and producing at once the most economical and efficient artificial illumination yet known to man, and which may well be called "one of the great inventions of the nineteenth century." And thus he goes hand in hand with nature in all the ways of his profession, so differently from his friend, the electrical engineer, who seems at all points to be endeavoring to thwart her, and, with his lamp, depends for his success upon his ability to oppose her. For nature abhors a vacuum.

And now comes the philanthropist, and desires to know why, under all of these advantages, the price of the product does not fall. Why are not companies formed to give it away, so that the people may rise up and call them blessed? The reply might be made that, in common with other corporations that deal with the public, they are always sure of the blessing. Perhaps a better reply would be that water is free, free as the air, and stored in inexhaustible quantities at the very doors of many of our cities; and yet it costs the people of most cities more than gas. Suppose it were

* At the gas works in charge of the writer, four hundred miles from the coal mines, the residuals sold pay more than eighty per cent. of the coal bill.