rants, might visit all occupied dwellings, etc., on each line of sewer. That being done, a flushing van might be employed to discharge into the manholes such a quantity of water, mixed with the deodorant, as would effectually cleanse and flush the sewer in question. The deodorant recommended is manganate of soda, and Mr. Boulter thinks that if this proposed system were properly carried out there would be far fewer complaints regarding smells from ventilators.

WASTED HEAT.

BY A. M. WICKENS.

Our subject is very far-reaching and cannot be fully gone over in a paper as short as this one must necessarily be.

As heat is the source of all life, and also of all motion, its influence permeates everything in the whole universe. The great heat given to the countless worlds that travel their orbits, in a boundless and immeasurable space, is the sun. Sir William Herschel tells us that if a cube of ice 45 miles in diameter and 200,000 miles long were plunged endwise into the sun, it would be melted in one second of time. What the effect of this vast heat is on other worlds we cannot tell; what the condition of life, what manner of souls, what kind of an atmosphere, nor in fact any of the particulars we know not. Had we a full knowledge of all these things we undoubtedly would be able to utilize the great sun heat to create our motive power direct from its rays; but while our knowledge of other worlds is extremely limited, we have been able to learn something concerning our own surroundings and the wonderful combinations of nature provided by an all-wise Providence for the use and benefit of the inhabitants of this earth. If we could imagine anything perfectly cold, it would be without motion, perfectly still, and absolutely dead. The earth, the rocks, the trees, the air, are all moved continuously and subject to vibration, the direct cause of which is the heat and light of the sun's rays.

The human eye and ear, two of the most wonderful parts of our organism, would be useless to us as they are now constructed, were it not for the vibrations of the light and heat of the sun coming to us through the atmosphere surrounding the globe.

It is by utilizing the principles of these vibrations that we have telephones, telegraphs, electric lights, music, and many of the conveniences and pleasures of life. And as we become more enlightened on this line, it will be safe to say that much of the complication of construction and cost of operating and maintenance, in all these different branches, will be greatly reduced, and we should also expect as we gain knowledge to be able to show better results in the evaporation of water for power purposes. In following the theory of heat for this purpose, I do not expect to be able to give you anything new, as I can only follow old and well known tracks. Still, if I can so state some of the facts, and so put some of the deductions to be had from such facts that I can start the body of progressive and representative engineers to think long and deeply on the subject, I will feel that my effort has not been in vain.

The efforts of the eminent engineers of the world during the last 50 years have been, in a great measure, directed toward the improvement of the steam engine; their strides have been rapid, their achievements great, and their success almost phenomenal, resulting in a reduction of the amount of water consumed per horse-power, per hour, from about 60 to 12½ lbs. This must be very gratifying, and of great benefit to the manufacturers of the world; but, strange to say, while all this improvement in steam engines has been going on, the steam boiler has not kept pace with the other improvements, excepting in the matter of strength. The efficiency and evaporative capacity of our boilers of to-day is very nearly the same as they were 40 years ago, and very often a new high-class engine is attached to and takes steam from the same old generating device. Now, it seems to me, that a further economy must come from a better application of the heat derived from the coal or other fuel used, and who is or should be better able to do this than the engineer? The man who daily utilizes the heat should, if he will study up the requirements, be able to devise means to convert into mechanical work a greater portion of the heat of the fuel than is now generally utilized. It is evident that in order to do this, he must first acquaint himself with the component parts of the fuel, and the chemical combinations that occur during its combustion. The advancement of all science during the century has been exceedingly rapid; galvanism, magnetism, electricity and chemistry have been factors for our general use, and are being greatly improved by the master minds of our scientific men. The greatest discovery in chemistry was oxygen, made by Dr. Priestly, in 1774; its discovery was really an accident, but was soon turned to account by the learned doctor. In the study of chemistry several things should be kept in mind: 1st. Where is the element under study to be found? 2nd. How can it be obtained in a separate state? 3rd. What are its properties? 4th. What other elements will it combine with, and what will be the compounds?

Oxygen is the most widely connected with the other elements of all our gases; it composes about one-fifth of the atmosphere and fully eight-ninths of all the waters of the globe are pure oxygen. Its most remarkable propensity is its energy in supporting combustion, and anything that will burn in atmospheric air will burn with the splendor of a meteor in oxygen. Nitrogen, another of our gaseous elements, is part of our atmosphere, and composes about four-fifths of the atmosphere. It combines with the oxygen—but not chemically—(as we will see later on.) It will not support either life or fire, and in its combination with oxygen it serves to dilute it in order that we may not live too fast—that our fires, and lamps, and any other materials may not burn too fast, and that our iron utensils may not rust too fast. The atmosphere being composed of oxygen and nitrogen, we have these elements to combine with our coals in order to get the heat. Taking an average quantity of American bituminous coal, we find its component parts are carbon, oxygen, hydrogen, ash and sulphur; we have then air composed of oxygen 21 parts, nitrogen 79 parts, and coal composed of carbon 80 parts, of which 20 are very volatile. Oxygen 16½ parts, hydrogen 6½, ash and sulphur 3 parts. Now what occurs when these elements are combined? The oxygen combines with the combustible matter and forms a chemical gas; while the nitrogen remains neutral and is still nitrogen, showing that its combination with the oxygen is mechanical, and the proportion of the mixture is by weight oxygen 1° to nitrogen 3.35°.

Now, to make perfect combustion, we supply 1° of carbon with 2.66 lbs. of oxygen, carrying with it 8.94