The gas mantle by which the illuminating power of gas is raised from 16 to 60 candles on a consumption of 3½ feet an hour constitutes one of the most signal triumphs of chemical research. Certain sands found in Brazil and known as monazite sands had long been a happy hunting ground for chemists by reason of the number of rare metallic elements to be found therein. They seemed to be a sort of chemical garret where everything not otherwise used up during the process of creation had been stowed. Dr. Carl von Welsbach was investigating the rare elements in these sands some thirty years ago and studying their spectra. It occurred to him that a better flame for his purpose, or rather a better distribution of the metallic vapor in the ordinary Bunsen flame might be secured by distributing the metallic compound through the substance of a bit of cambric. He dipped the cambric in a solution of the salts, suspended it in the flame, burned off the cotton, and found that the fragile ash glowed with an amazing brilliance. So came into being the gas mantle which has revolutionized and saved the illuminating gas industry, though not until the initial discovery had been followed by years of the most painstaking and refined research.

A large pulp mill found itself with over 100,000 cords of peeled wood piled in its yard and this wood was beginning to rot. A few thousand gallons of sulphite liquor sprayed over the pile from a garden hose killed the fungus and saved the pile. The same mill was losing 23 per cent. of its wood as barker waste. Laboratory trials proved that an excellent quality of paper could be made from this waste, all of which in this mill is now profitably worked up. Other mills still throw 20 per cent. or more of their initial raw material away. The mill was cooking in 16 hours. Laboratory cooks were made in 7½ hours and the time of the mill cook reduced to 10. Finally, by a proper spacing of the digesters, the production of the plant was brought from 97 tons a day to 149 tons.

Cylinder oils generally cost about what you are accustomed to pay. Plants which employ a chemist pay from 19-27 cents. Manufacturers who do not need a chemist commonly pay 45 cents, 65 cents or even, if they know their own business very well, $1.50 a gallon. There is probably not a large plant in the country in which, if it is not already under chemical control, the lubrication account cannot be cut in two. In the engine room of one large cement plant the average monthly cost for lubricants had been $337.00. It is now $30.00. A concern paying 37 cents a pound for a special grease which the superintendent needed to run the mill now buys on speculation for 5½ cents, and the mill still runs.

Chemistry points out the only proper way to buy supplies which is on the basis of their industrial efficiency by means of defining the quality desired and rigid test to make sure that quality is secured. Independent estimates by those in position to know, place the efficiency value of supplies as purchased and used by United States manufacturers at 60% of what it should be.

Many manufacturers fail to realize that in buying coal they are in reality buying heat, and in many instances they pay for slate and sulphur with no knowledge of the actual number of B. T. U. they are receiving for one dollar.

Important as are the losses in the initial purchase of coal, they are small compared with those which attend its burning. Many a mill owner looks out of the window and sees, without knowing, his dividends go up the chimney. Under well regulated conditions of combustion the flue gases should contain not less than 12 per cent. of carbonic acid gas. They frequently contain no more than 3 per cent. This means that for every ton of coal burned under the latter conditions more than 52 tons of excess air are heated to the high temperature of the flue gases. Chemistry meets these conditions by analyzing the flue gases and regulating the draft as indicated by the percentage of carbonic acid found. At $2.25 a ton, which is much below the average price, the fuel bill of the United States was over $1,000,000,000 in 1910. Of that amount chemistry could easily have saved $100,000,000.

Chemistry aids the manufacturer who will listen to her teachings in countless other ways. It substitutes a rigid control of processes for the guesswork and uncertainty of the rule of thumb. It increases the productivity of labor by supplying more efficient processes.

"The United States is the most wasteful nation in the world; wasteful in living, wasteful in manufacturing, and wasteful in conserving its natural resources." So heedless and appalling is this waste that the mind trained in chemistry stands aghast. I have lately visited a southern lumber mill which burns 1,900 cords of wood a day in its incinerator. There are two hundred such burners in the country limited in destructiveness only by the amount of material sent to them. From such wood chemistry is prepared to extract three gallons of turpentine a cord, 10 gallons of ethyl alcohol, or paper pulp to the value of $20. We waste each year 500,000,000 tons of coal and each day a billion feet of natural gas. With peat deposits fringing our entire eastern coast we pay $4 a ton for coal delivered on the bog. Beehive coke ovens flame for miles in Pennsylvania and excite no comment while the burning of a $1,000 house would draw a mob. We fill the Merrimac River with wool grease making it a stench, while the towns along its course buy soap and fertilizer and lubricants from Chicago, Chili and Pennsylvania. We burn coal-tar in Massachusetts and import coal-tar colors at high prices from Germany. Over the great North-west we burn each year 5,000,000 tons of flax straw while we pay $40 a ton for imported paper stock from Norway. In the South 300,000 tons of paper fibre of the highest grade are burned with the cottonseed hulls to which it is attached or used with them to adulterate cattle feed. Cornstalks to an incalculable tonnage rot or are burned each year while chemistry stands ready to convert them into feed containing 30 per cent. of sugars on the dry basis, or into alcohol for light and power. Waste molasses is sold for three cents a gallon or dumped into the stream while alcohol sells for 40 cents a gallon. Skim milk is fed to hogs or thrown away because no one has the enterprise to extract its casein which is worth more than beefsteak for food.

In the face of such conditions we still meet young men who would inform us that the day of opportunity is past. The truth is that opportunity is knocking not once but insistently and long at every entrance to the chemist's laboratory.

Nowhere is the earning power of chemistry better shown than in its ability to transform cheap raw materials into products of exceptional value. A cord of wood is worth perhaps $10 with a dry weight of a little over a ton. Its value, therefore, is about a half a cent a pound. In the form of chemical fibre for paper-making half the weight is lost but the remainder is worth 2¼cents a pound. As paper it finds a market at 4 cents. Made into artificial silk by more refined chemical processes it commands $2.00 a pound, while as cellulose acetate bristles it is worth $4.00.

There are in the United States at least 100,000 doctors and nearly 125,000 lawyers. There are only 10,000 chemists to carry on a work incomparably more important than litigation and no less beneficial than medicine to the life of the community if that life is to be worth living. Some measure of the mere material benefits which chemistry can offer may be found in