"2. That we return to the open fire-place or the grate as a means of warming our houses.

"3. A diminished consumption of oxygen by gas burners. It is still an open question whether we shall be able to light our dwellings with electricity, but so long as we are obliged to depend upon gas we must content ourselves with light, and not insist upon illumination.

"The concessions demanded are named in the order of their importance. The necessity for each is urgent, but the first admits of no compromise. But there are many other possible sources of ill-health, and physical decay incident to the civilization than those I have referred to especially. The wholesome light of the sun is partially excluded from the apartments of wealth and luxury, because it fades the costly rugs and drapery and offends the educated eye by its vulgar and intrusive garishness, and not unfrequently at large receptions the light of day is excluded wholly, in order that the more æsthetic and kaleidoscopic effects of gaslight may be substituted, regardless of the fact that the air is thus rendered unfit for respiration. Our social habits demand that both children and adults shall devote the hours nature intended for sleep to amusements, which amusements are rendered more intoxicating and pernicious by the prolonged respiration of heated and poisonous air. Dress makes its contribution. Utility and regard for health are almost invariably made subservient to the caprice of fashion and the study of effect. Flimsy head-dresses, low necks, short sleeves, tight corsets, high heels and narrow toes do not contribute the sum total of the æsthetic requirements of civilization in matter of dress. Walking as a means of locomotion and of exercise is rendered difficult and sometimes impossible. To romp, or even to move with rapidity and sharp angularity, is unseemly in young ladies. And such young men as "move" in the most refined and polished circles, neglecting robust and manly outdoor ekercises, pose in attitudes which demand the least possible muscular exertion, or dawdle in effeminate dissipation. In the "best" society there is neither muscle nor backbone. Almost all respectable citizens ride when they might walk and complain of the want of breath when the absence of an elevator compels them to ascend a flight of steps, even when travel, overheated cars, long confinement in one position, hurried and irregular meals, dust and smoke, bring us to the end of our journey, weary and often sick. Railroads have enabled us to accomplish more in life than was possible when men travelled in coaches or on horseback; but it is doubtful whether, in the shortening of human life it has effected, the loss is not greater than the gain. All of these evils, and thousands not enumerated, are the necessary incidents to civilization, and medical men are painfully familiar with the impediments they present to the preservation of individual and public health; indeed, as has been already suggested, it was the presence of these evils chiefly which has rendered our existence as an integral part of society necessary. Nor do I assume too much in saying that were it not for the teachings of medical men the physical decay of the human race, under the adverse influences of civilization, would be rapid and complete.

Dr. Hamilton's paper was discussed by Dr. Billings, of the National Board of Health, and by Dr. Doremus, Dr. A. H. Smith, and Dr. E. G. Janeway. The academy voted to join with the Sanitary Reform Association in asking the Legislature to permit no tampering with the law for the registration of plumbers, etc., enacted last winter.

Engineering, Civil & Mechanical.

HOW TO CALCULATE SPEED.

We publish the following plain statement of a simple rule for calculating speed, taken from an exchange, as we believe it will prove interesting and instructive to many readers:

In selling machinery, the maker usually recommends that it be run at a certain rate of speed which has been demonstrated by experience to be most favorable to its successful operation. To fix upon relative size of pulleys to be used in communicating this motion from the "line shaft" is a calculation which seems to be very imperfectly understood by the average mechanic. Conversation on the subject with a large number of engineers, millwrights, and others has led us to think there was a demand for more light, and we accordingiy offer the following system, the convenience and accuracy of which have been proven by years of practical use. This simple example will illustrate: Given, a 20-inch pulley revolving 100 revolutions per minute, how fast will a belt from it drive a ten-inch pulley?

The "rule" laid down in the book says: "Multiply the diameter of the driving pulley by its revolutions per minute, and divide by the diameter of the driven pulley." I find no fault with this rule, but would suggest that the teacher and text book of the future will be successful in proportion as they abound in "reasons why," and give the student principles from which to form his own rules. As every rule must be based upon a principle, when one is familiar with the latter the former becomes self-evident and not easily forgotten. The speed of a driven pulley will bear exactly the same relation to the speed of its driver as its diameter does to the diameter of the driver.

In the above instance, the driven pulley being smaller, let its size represent the denominator of a fraction, of which the diameter of the driving pulley shall stand as a numerator, thus:

$$\frac{20}{10} \text{ of } 100 = 200.$$

Or, suppose the diameter of the driver was 25 inches, its speed 180, and a speed of 600 was required, what must be the diameter of driven pulley? Reasoning: Since the speed must be greater, its diameter must, of course, be less than that of the driver. How much? As much less as its speed is greater; thus its size will be.

$$\frac{180}{600} \text{ of } 25 = \frac{75}{10}, \text{ or } 7\tfrac{1}{2} \text{ inches.}$$

This not only leaves less room for a misstatement of the problem, but in most cases the multiplications and divisions may be made mentally, thus saving time and avoiding liability to error.

These advantages are of still greater importance where intermediate pulleys or "counter" shafts are used to multiply motion. For instance, it is required to "set up" a planing machine, the cylinder of which must run 3,500; it has a pulley 4 inches; the counter shaft has pulleys 6 and 24 inches, respectively; the line shaft runs 160; what size driving pulley will be required? Reasoning: The 4-inch pulley being driven from one 24 inches, the larger pulley will revolve as much slower as 24 is greater than 4, and the drive pulley on line shaft must be as much larger than the driven or counter shaft, as its speed is slower than that of the counter shaft which it drives. The entire operation may be analysed as follows: for the sake of clearness, I will suppose that the motion was communicated direct from the line shaft to the 4-inch pulley, in which case the drive pulley must be.

$$\frac{3,500}{160} \text{ of } 4, \text{ or } 87\tfrac{1}{2} \text{ inches.}$$

The use of a counter shaft will decrease the size of driver exactly in proportion to the relative size of its pulleys. In the above instances the pulleys on counter shaft are 6 and 24 inches; consequently the driving pulley will only require to be 6-24ths as when no counter shaft was used, and this being understood, the whole problem may be disposed of as follows:

$$\frac{3500}{160} \text{ by } \frac{6}{24} \text{ by } 4 = \frac{175}{8}, \text{ or } 21\tfrac{7}{8} \text{ inches.}$$

—*Apprentice's Journal.*

EFFECTS OF HEAT UPON STEEL.

The illustration shows the effect of heat upon steel. To produce these effects take a bar of steel of ordinary size, say about an inch by a half, and heat six or eight inches of one end to a low red heat, and nick the heated part all around the bar at intervals of half to three quarters of an inch, until eight or nine notches are cut. The nicking is done at red heat, to determine the fracture at the nicks. Next place the end of the bar in a very hot fire and heat it white hot until it scintillates at the the extreme end leaving the other parts enough out of the fire to heat them only by conduction. Let the end remain in the fire until the last piece nicked is not quite red red-hot, and the next to the last barely red hot.

Now, if the pieces be numbered from one to eight, commencing at the outer end, No. 1 will be white or scintilating hot, No. 2 will be white hot, No. 3 will be high yellow hot, No. 4 will be yellow or orange hot, No. 5 will be high red hot, No. 6 will be red hot, No. 7 will be low red hot, No. 8 will be black hot.