

in its medicinal properties. Butter and milk are cheaper in France than in England, potatoes the same price: beef costs about 10 per cent. more, bread 15 per cent. and flour over 50 per cent. more, while coal is 70 per cent. dearer. On an average the French workman receives only three-fourths of the wages of the British workman, and the average German wages are only 83 per cent. of the average wages in England. To take particular trades, for every 100 shillings an English mason or bricklayer receives the Frenchman only gets 65 and the German 75, while against the English carpenter 100 shillings the Frenchman receives 72 and the German 77. And, further, the English workman has a week of only 52½ to 53½ hours, whereas the Frenchman works 59½ to 64½ hours, and the German almost universally 58 to 59½. Altogether the British workman seems distinctly better off than his Continental brother.

SAFE WORKING PRESSURE OF BOILERS.

The safe working pressure of a boiler is a pressure sufficiently below the estimated bursting pressure to warrant confidence in its perfect security at that lower pressure, which therefore involves a factor of safety. For example, a boiler whose bursting strength would be estimated at 400 lb. per square inch would have, at a factor of safety of 5, a safe working pressure of 80 lb. Various rules are used for this calculation, some partly empirical, and none upon which all authorities are ready to agree as to correctness. The riveted joint is the feature which complicates the problem, and which largely affects the strength of a boiler. Joints of different types have different degrees of strength relative to that of the solid plate, and each must therefore be treated individually in calculations. However, for a simple general rule for safe pressure we may quote that of the U. S. statutes, governing marine boiler inspection. This is $P \text{ eq } \frac{2}{3} \frac{T}{t} \frac{D}{6}$ where P eq. safe working pressure in lb. per sq. inch, t eq. thickness of plate in inches, T eq. lowest tensile strength stamped on any plate, in lb. per square inch, and D eq. diameter of boiler in ft. The factor 6 is supposed to represent the combined factor of safety and efficiency of the riveted joint. The formula as given is for single riveted joints, to which 20 per cent. is to be added for double riveted in both cases.

EFFECTS UPON RESPIRATION.

The engineer who attempts to master the problems of mine ventilation, should be familiar with the effects upon human respiration of an atmosphere containing more or less than the normal proportion of oxygen. A normal atmosphere may be regarded as consisting of two gases—oxygen and nitrogen—mixed together in the approximate proportion of 21 per cent. of the former to 79 per cent. of the latter. The proportion of oxygen in mine air may be reduced to as low as 15 per cent. before a person is likely to experience any difficulty in breathing, although lamps and candles will not burn in such an atmosphere. Any further reduction, however, is attended with serious consequences. When only 7 per cent. of oxygen is present in air, the face of the individual becomes gray, the lips blue, there occurs palpitation of the heart and a general dulling of

the senses. Since a small deficiency of oxygen occasions such little actual discomfort, great care must be exercised in entering places where there may be a lack of this life-sustaining ingredient, as there are no preliminary symptoms, and in an atmosphere entirely deficient in oxygen a man would become unconscious in 30 or 40 seconds, with little or no preliminary warning. It is also true that in deep mines, where the atmospheric pressure is greater than that ordinarily prevailing at the surface, a man may safely breathe an atmosphere containing a slightly lower per centage of oxygen than might be considered sufficient at ordinary pressure.

GAS OR DUST?

One of the important points brought out at a recent meeting of coal mining men was with reference to the general tendency of attributing most of the recent mine explosions to coal dust as the destructive agent. A number of engineers now claim that the coal dust theory is being brought in to explain explosions that are due to gas. Attention was called to the fact that in a number of recent cases, the miners, evidently realising that something had gone wrong in the mine, were trying to escape by rushing to manholes when a second explosion occurred and killed them. First of all, there was an explosion caused probably by the firing of a shot, and a second explosion accompanied by the production of a partial vacuum, ensued after a short interval. The general opinion was that the second explosion was due to gas and was more disastrous than the first. One investigator called attention to experiments made in a gallery of boilers, where the real damage was caused by a detonation where there was an open end to the gallery, only three boiler lengths away. In explaining the results of this experiment, the speaker said that when the first explosion had taken place, carbon monoxide was left behind, and in this particular instance, the carbon monoxide was detonated.

BROTHERHOOD OF MAN.

A remarkable illustration of the dangers of pit working and the self-sacrifice of miners to help a comrade has come to light from Saline Valley Colliery, Fifeshire. Three men—Richard Bennett and John Gillespie, contractors, and David Cleminson, fireman—were on duty driving a mine from the 'Wee Pit' to work a seam of coal in the eastmost pit, which has been standing idle since the beginning of the year. Suddenly an enormous burst of water took place from the pavement. The inrush of the water had the effect of extinguishing the lights of the three men, who lost each other. Bennett was not well acquainted with the workings, and lost himself in seeking to gain a place of safety from the rapidly rising water. Immediately the circumstances of his imprisonment were realized, Mr. Cleminson, the manager, organised a rescue party of four, with three others to watch the rising water and to give prompt warning when it threatened to cut them off. Before they could reach Bennett, who was lying in a high place in the 'waste', the rescuers had to cut through twenty feet of a fall, necessitating several hours' work. By this time the water had attained a great depth, and before Bennett could