recognized that the gases occluded in the pores of the coal—more particularly oxygen—are indirectly the cause of both heating and deterioration, and their escape should as far as possible be arrested. By immersing coal and keeping it continually sealed this condition is fulfilled, the gases being more or less confined, while little or no oxidation takes place. The breaking up of lumps and pulverization are considerably reduced, because the water forms a cushion between the various pieces, thus lessening the effect of the movement of the lumps one on another, though the better physical condition of the coal is probably due in part to absence of heat, which in itself is to a great extent the cause of the opening out and disintegration of the larger pieces.

Authorities on the question of coal storage are now generally agreed that no air-stacked heap—whether housed or in the open—should be taken to a greater height than about 20 ft., chiefly on account of the danger of the formation of "dust-pockets," which are frequently the primary cause of ignition. There is, however, no limiting depth in the case of an immersed stack, and accordingly a considerable saving of space can be effected. This, again, is a material consideration from the point of view of works lying in the centre of congested districts, where vacant spaces are limited and the price of land excessive. For instance, if 20ft. is to be the maximum height of the stack, the storage capacity is limited to between 40 and 50 tons per 10 sq. yards of ground area, and thus an acre of ground space will accommodate, at the outside, only some 20,000 tons—by no means an excessive quantity in view of the huge demands of industries such as gas-making, in which the larger works carbonize as many as 1,000 to 2,000 tons a day, and in some cases even greater quantities. By adopting the wet storage method the capacity per unit of ground area could certainly be doubled, and there is no reason why it should not be even greater.

Possible Defects.—With all its possibilities and advantages, the storage of coal under water is sure to introduce a certain number of undesirable factors, and perhaps the most serious question to be taken into account is that of expense. At present the cost of stacking coal is considered to be no more than the value of the ground upon which the coal stands, although in addition there should be reckoned the expenses of constant supervision and labor in turning over and working out suspicious parts of the heap. The expense of conveyance to and from the stack may be neglected, because it is necessary in both cases, the extra depth in the wet method being balanced by the saving of distance.

The coal reservoirs—usually constructed of reinforced concrete—must, of course, be designed with foundations varying in accordance with the proposed depth, and in the event of the latter being considerable the expense is somewhat heavily increased owing to the great pressure on the floor and side walls. A further consideration is that of pumping machinery for emptying or filling purposes.

A contingency which must not be overlooked is the possibility of sudden frost and the consequent freezing up of the reservoir to some considerable depth. It is improbable that anything of the kind would occur in this country, and in places where intense cold prevails wet storage would be unnecessary owing to the limited amount of deterioration and greater immunity from fire in such climates.

There is, however, an admirable system in vogue known as the "mixed method," according to which a supply of coal is stored in the open for immediate requirements, and the deficiencies are made good by deliveries. At the same time a certain quantity is stored in the water reservoirs, and this is set aside for use in the case of emergency only. Even should ten years elapse before an emergency arises, the coal (as previously pointed out) should be found to have deteriorated to only a very slight extent.

One of the largest reservoirs constructed for the purpose of storing coal under water is that which it was decided to erect at Stettin about two years ago. The tanks, on the banks of the River Oder, were designed to be capable of dealing with 20,000 tons. Towards the close of 1911 arrangements were also completed for storing 6,000 tons of coal in this way at the works of the Omaha Electric Light and Power Company, and a most elaborate coal-handling plant was erected for working in conjunction with the tanks. In this case the tanks are comparatively shallow, their depth being 22ft., and the side walls are carried on piles owing to a treacherous stratum of quicksand. Piles at a pitch of 5ft. were also driven under the whole of the floor area and capped with square slabs of concrete, upon which the floor rests. In this way the whole of the load is brought upon the piles and none of it is upon the earth. The side walls are about 2ft. thick at the top and 4ft. 6in. at the bottom, and the concrete floor is protected from the bite of the coal "grab" by means of embedded rails.

Effects of Using Wet Coal.—When coal has been subjected to storage under water for any length of time it is usually found to be somewhat brittle and decidedly dull in appearance. But the latter effect is merely superficial, and on drying in the sun it rapidly disappears. In many cases, however, time would not permit of the coal being set aside for drying, and the consumer would be faced with the difficulty of using fuel containing a high percentage of water. For steam-raising and all firing purposes this would no doubt be of little account, but the question cannot be considered lightly when the coal is destined for gas-making purposes. It has long been a general belief—probably an exaggerated one—that if wet coal is carbonized in gas retorts the proportion of impurities will be increased and, in addition, greater quantities of the much-maligned hydrocarbon naphthalene will be evolved. Thus the storing of coal under water would be likely to meet with stout opposition from the gas engineer. However, full charges of coal (that is, charges that completely fill the retorts) are now the order of the day in the gas world, and under such conditions the moisture has practically no evil effect. At any rate, it should be found more profitable to carbonize a wet coal giving a slightly increased yield of impurities than an air-stacked coal which had lost perhaps 10 per cent. of its gas-making value.

SAFETY FIRST.

The Canadian Pacific Railway Company has ordered a sheet filled with mottoes of "safety first" propaganda for distribution. Points already emphasized by numerous safety committees are brought out, as follows:—

I will not stand in front of a moving car, or engine, to board same.

I will always respect the blue flag, because the lives of my fellow-employees depend upon it.

I will not hold on to the side of a car when passing platforms, buildings or obstructions close to the track.

I will not shove cars into a freight shed, or on team tracks, without first making sure that all men and teams are clear.

I will not kick cars into sidings, where boarding cars, or cars being loaded, or unloaded, are standing.

I will remember that it is better to let a train wait than to cause an accident.

I believe that Safety First is simply a habit and I will cultivate the habit.

The prevention of accidents is a duty I owe myself, my family, and my fellow-employees.

I will take out immediately sufficient accident and life insurance to protect myself and those dependent upon me.