iences them in degree dependent upon distance from the neutral axis. On the assumption of the complete homogeniety of the axle as to structure, condition and internal strains due to heat-treatment, it would still be natural to expect that the outer portions (under stresses not sufficient to rupture the whole mass practically at once) would break not only first, but with the smallest amount of elongation, and that the central portion, breaking last, would show the greatest elongation before fracture, because it would have been exposed to gradually increasing stresses, as the progressive fracture of the outer concentric portions increased the intensity of stress upon those remaining. Another point deserves consideration, namely, that up to a certain stage in such progressive fracture, both bending and elongation of the outer layer are resisted by the rest of the mass, a condition which diminishes with the decreasing diameter of the unbroken central portion.

If it be supposed that the axle, by reason of its heat-treatment in manufacture, or for any other reason (such as different quality of its original parts), was not homogeneous in the respects mentioned above, the differences in its fractured surfaces might be increased. The instance cited by Mr. Argall, therefore, while it may be consistent with the notion that the railway axle in question was once wholly fibrous, as at C, and had become, in use, crystalline at B, before its fracture, does not require or prove that theory.

R. A. HADFIELD, Sheffield, England (communication to the Secretary)—I have long entertained the idea that many of the so-called fractures by vibration were really due to previous, and often careless heat-treatment. I can say, after personally handling a very large number of specimens, that I have never yet found a case which could not be satisfactorily explained when the previous heat-treatment could be traced.

F. OSMOND, Paris, France (translation of a communication to the Secretary)—Having read the discussion of this subject as printed thus far,* I take occasion to say that I am fully in accord with Dr. Raymond's view. I know of no fact which demonstrates the crystallization of iron by vibration; and all that I do know is opposed to that opinion. The aspect of the fracture depends upon the original quality of the iron and the mode of rupture.

As to the formation of *beta*-iron by shocks and vibrations, that is another question. As Dr. Raymond has correctly pointed out, it is only in the case of permanent deformations that the production of *beta*-iron can be seriously argued. It appears to be, however, not impossible that the elastic limit may be exceeded *without apparent deformations* under the action of vibratory forces which operate at each point for an extremely short time only. But this is a mere hypothesis. If it is well-founded, it could be verified by determining the coercive forces of the iron before service and after rupture. The production of *beta* iron would be indicated by an increase in permanent magnetism. The truth is, we know at present almost nothing as to the transmission of mechanical waves.

* Not including the present pamphlet.—R. W. R.

Mining Reports and Mine Salting.*

BY WALTER MCDERMOTT.

There is such a great variety of badness in mining reports that a little grouping of the cardinal sins will be useful. In speaking of mining reports generally, for the purpose of illustration, I intend to cover, not only those made by mining engineers, but all those used in business, and so fairly subject to criticism,—from that of the learned professor of other sciences who is dragged from ths seclusion of his study and put underground to be made miserable with candle grease, down to the practical miner, who, having beaten a drill for a certain number of years, is prepared to dogmatize also on facts, figures, theories and conclusions.

Amongst the old friends we meet in numberless reports, and which seem to need a little protection against excessive wear and tear, the following will be considered: (1) the true fissure vein; (2) increasing width in depth; (3) increasing richness as depth is attained; (4) junction of veins; (5) ore in sight; (6) proximity to a rich mine; (7) failure from mismanagement. Now, Heaven forbid that I should be held as speaking disrespectfully of any one of these things, each estimable in itself. My remarks are pointed only against their indiscriminate use, and particularly against their public use as catch-penny phrases in a way to imply more than they actually mean.

There has been more joy over the term "true fissure vein" than over anything else in the history of mining. The investing public has become intoxicated with the exuberance of its descriptiveness. The practical miner has grasped its effectiveness, and the first ring of his pick on an outcrop satisfies him that he has got the the genuine article with tap roots in the antipodes. What is a true fissure vein? It is supposed to be a fissure in the country rock filled with veinstone, which may be expected to go down to a considerable depth. The veinstone itself sometimes carries pay ore. This does not seem much to base any elaborate calculations on; and not only is it insufficient, but experience all over the world has shown that some of the most valuable ore deposits are not found in fissure veins at all. Even as far as mere depth is concerned, it is by no means yet established that true fissure veins go any deeper into the earth's crust than bedded deposits, contact, or pipe veins; and it would be of no consequence if they did go deeper, since they cannot be followed. Properly used, the term "true fissure" is usually descriptive, but where used as an incantation to call up visions of wealth to unlimited depth, it needs suppressing.

It is naturally gratifying to the owner of a mine to see his vein increasing in width as he goes down. It also looks well as described in a report, and must naturally be mentioned when it occurs; but in some reports the implication arises that it is a vital point and to be calculated on as continuing. If a vein went on increasing in width, it would very soon attain enormous dimensions, and, if it outcropped in a country blessed with the law of the apex, its lucky owner would have a good claim to a very large proportion of the earth when he got down a few miles. It may pretty safely be assumed that the increase in width will not continue, and, when it stops, it is very likely to be succeeded by a corresponding decrease, so as to keep upt he usual average of things. When, say, a 50 ft. shaft sunk on a vein shows an increase in thickness from 1 ft. at surface to 6 ft. at the bottom, there is nothing to show that, in continuing to sink, the vein may not gradually or rapidly pinch again to its size at surface, or even much less. If any calculations were justifiable at all in such a case, general experience would certainly lead one to expect such decrease. The only positive conclusion would be that the vein is irregular in width. It looks nicer and more definite to say simply, "the vein is steadily increasing in width as sunk on," than to state that "the width of vein is variable ranging from 1 ft. to 6 ft., and therefore, until further opened in length and depth, its average cannot be safely calculated on." The one statement is as true as the other, but the effect of the two a reading is not the same.

*Abstract of a paper read before the British Institute of Mining Engineers.

There is a touching confidence in the belief of many practical miners that veins get richer as they go down. Experience and disappointment often fail to shake this comfortable belief. Most practical men are able to cite a great many more examples of rich mines becoming poorer with depth than the reverse. I remember being struck with the inconsistency and persistency of the belief in depth in various camps of the Rocky Mountains. Up in the highest ranges, say 12,000 ft. above sea level, there are mines which need sinking on to prove their real value; and 7,000 ft below them in the foot hills are mines equally needing depth. Probably the thought at the bottom of this belief rests, like some of the attractiveness of the true fissure veins, in the old idea of a central seething mass of precious metals, and in the forcing up of a molten vein-filling. This faith in the saving grace of depth and of true fissure veins in the face of facts can be explained only by the definition of faith as given by the little girl—"believing what you know is not true." The hankering for depth has its justification of course, in the necessity for sinking usually to get any developments, but, where access is obtainable to the foot of a mountain through which a vein runs, the same men who claim a special efficacy for depth in other cases will point to the vast advantages of having the ground above one to be opened by adits. The facts of experience show that, when a vein is rich at the surface, a hope that it may continue is a more proper attitude than a belief that it will get richer in depth; and, when it is poor on surface, any change in sinking would be for the better.

Striking cases of enrichment of veins at their junctions occur; but, as many examples of junctions without richness also exist, it does not do to attach too much importance to the results to be expected. In some reports the future junction of two veins is often itself assumed on insufficient data, and the consequences are calculated on with a certainty which is still less to be justified.

Under the head of "ore in sight" is included matter which is of the very greatest importance, and which requires the very best work of an engineer. The estimation of ore in sight in an opened mine often involves the consideration of so many points, and is so largely a matter of good judgment, that one may expect some discrepancy in the reports of different engineers. There is nothing in which such vast discrepancies do exist, in fact, as in regard to this. Two good engineers will vary in their estimate; and, when it comes to inexperienced men, or to so-called practical men who have no reverence for the written word, the term "ore in sight" becomes a theme for the exercise of the highest flights of the imagination and the airing of a little rudimentary mathematics.

In the common mining report we are all acquainted with, it is not unusual to see the length of the chain multiplied by a cheerfully assumed average width of vein, then by 500 or 1,000 ft. for depth, and a tonnage deduced which reminds one of the figures used for astronomical purposes. Sometimes, to inspire extra confidence, the expert generously knocks off 25 or 50 per cent., and feels he has then done his duty, whatever happens. The character and ability of a man can sometimes be closely estimated from the way he figures up ore in sight after giving the dimensions bearing on it; and it often suffices to look at this calculation in order to determine a report to be, not only quite unreliable as to conclusions, but equally irresponsible as to data.

In connection with estimation of ore in sight, the system of sampling employed is worth mentioning here. In some reports the expert writes of taking samples "at random.' When a man says he has picked some samples from a dump "at random," and they assay well, he implies that such ore is plentiful on the dump, and that he did not purposely select it from its appearance. What his statement actually means is that on an important matter he was willing to trust to luck as to whether he hit poor or rich ore, or whether he was getting just what had been previously placed for him to get. Luck is a very necessary thing in mining, but it should not enter into sampling. If the sample is a random one, its value proves nothing. Some people seem to think this method of sampling is important evidence of an impartial mind, and that shutting the eyes is the best security against the frailty of human nature, which would otherwise lead a poor creature to pick out the richest looking ore he can find.

Another little weakness to be remarked in some reports is the willingness to make a liberal discount off the expert's own figures. The writer concludes, for instance, from his samples—perhaps taken at random—that a gold vein will average 2 ounces of gold to the ton, but, to be on the safe side, generously offers to take it at 1 ounce, and then with a light heart goes into calculations of profits by day, and month, and year. If a man knocks off 50 per cent. from his supposed reliable figures to be safe, it always occurs to me that the one who reads his report may feel tempted to lop off another equal percentage to be still safer.

There have been plenty of illustrations lately published in prospectuses of the great value the public places on a property which is near a well-known mine; yet everyone who knows anything of mining must be aware that mere proximity to a paying mine gives no assurance of similar success. Some of these reports are absolutely nothing but a statement that the claim examined is on the same reef as, or near to, another property which is popularly supposed to be exceedingly valuable, and that rich ore has been found on the claim.

In quartz mining it sometimes happens that a series of paying mines are found at intervals along a single vein. Occasionally the intervals between pay shoots are long, so that a good mine may be immediately surrounded by poor ores. In other districts one single good mine on a vein is all that is ever developed. The only actual advantage of the proximity of a good mine is the evidence it affords of there being payable ore in the district, or on a certain reef. Like other indications, it is of service only when used with discretion, but as an unqualified argument of the value of a neighboring claim it is most dangerous.

That bad management may spoil a good mine is so self-evident a proposition that no one will misunderstand a few remarks against the improper or thoughtless use of this excuse in a report as an explanation of previous failure in a poor mine. A well-known Californian mining man, when asked to take charge of a mine which had failed to pay—as it was explained—from mismanagement, answered that he did not want anything to do with a mine which would not stand bad management. This is a remark which contains much matter for reflection, and embodies the opinion of most practical men In reports the statement is sometimes loosely made that milling results in the past cannot be relied on, owing to primitive machinery or processes hitherto employed This argument has often been advanced on Mexican mines by experts who have not had time to find out that native methods of working often give better results than the rapid working by the most modern machinery.

After all these remarks as to what mining reports ought not to be, it is perhaps permissible to say a few words on what they ought to be. A report need not be long-winded to justify the fee paid for it, but should be so full in actual description as to enable a reader experienced in mining to draw his own conclusion from the facts given, without having to trust entirely to the deductions of the writer. Where a fee is paid for a simple expression of opinion or specific advise, there is no need of a report, in the sense of the word as we are now considering it. The important details to be set forth clearly are those relating to position, and facility of access to the property; local conditions as to fuel, water, and timber supply; extent and form of openings; variations in thickness of deposit; character and value, and form of occurrence, of ore. It is important in giving a clear idea of the property that the distributio.. of the payable ore in the deposit should be described. It makes a great difference sometimes in the conclusions to be drawn whether the value consists in rich ore occurring in a barren vein mass, or in high-grade ore scattered through a low-grade deposit, or in a