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INDUSTRIAL ALCOHOLISM.*

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WHEN your Secretary did me the honour of inviting me to open the discussion this afternoon, he also gave me the privilege—or perhaps I should rather say he laid upon me the further task—of selecting its subject. And after much consideration I have ventured to choose as the theme of this paper the question of industrial alcoholism. Apart from the importance which naturally attaches to this question, by reason of its obvious bearing on national efficiency, it has, I think, a special claim on our attention just now, because its recent history exemplifies with peculiar force and clearness the practical value of that enlightened policy of liquor control, for which this country is indebted to Lord D'Abernon. It is, as you know, a distinctive feature of this policy, in contrast with previous efforts purporting to deal with the drink problem, that it is essentially preventive in aim, that it is directed, not merely to repairing or attempting to repair the evil results brought about by the prevalence of excessive drinking, but to counteracting the original causes which lead to such excess ; and the attainment of this aim has been nowhere more clearly apparent than in relation to the form of alcoholism which we are discussing to-day. It will, therefore, I think, be of interest, as illustrating the operation and explaining the success of this new principle in temperance reform, if, in examining the problem of industrial drinking, we direct our attention more particularly to the question of the causes on which this type of drinking depends. That is the aspect of the problem which will be specially considered in this paper. And there is a

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further reason for this limitation of our purview in the fact that the wider issues of the question have been fully dealt with in the valuable paper read before our Society last July by Professor Stanley Kent.

To start by defining our subject, you will recollect that industrial drinking is the term which has been used to describe the habitual taking of alcohol at frequent intervals during the hours of work, to relieve fatigue, and as a supposed aid to muscular effort. It is a type of drinking which is practically confined to workers engaged on heavy manual labour, where there is little demand for precision of movement and keenness of perception, and where, accordingly, the depressant influence of alcohol on these higher nervous activities is not a matter of any consequence. In considering, then, the physiological basis of this drinking custom, we need only concern ourselves with the effect of alcohol on crude muscular work; on work when the quantitative factor alone is important, and the qualitative factor is of little significance; and what we have first to ask in connection with such work is: In what sense can it be said that alcohol relieves fatigue? What is its real influence on the output of muscular energy? The answer which is most usually given to this question is to say that alcohol in one phase of its action is a stimulant, and, more particularly, a stimulant of motor function; that it enables the organism to draw more freely on its reserve energies, to put on a spurt when there is a temporary need of special effort. In support of this view a certain amount of objective evidence has been brought forward, obtained for the most part from experiments with the ergograph—an instrument which measures the number and the amplitude of the movements that can be made by a single finger lifting a weight, when the subject of the experiment contracts the finger at a definite rhythm until compelled to stop by fatigue. Working with this instrument, several observers have found that alcohol caused at first a decided increase in the number or in the amplitude of the contractions, or in both; this phase of augmented activity, of stimulation, being followed by a period of depression, during which the energy of the subject fell below the normal, so much so, indeed, that if the experiment were prolonged for any length of time, the total output of work was, as a rule, considerably less than when no alcohol was taken. This probably represents fairly well the most widely-held view of the effect of alcohol on muscular work. Ergographic experiments, however, are open to numerous fallacies, and they are specially liable to be vitiated by the influence of suggestion—an influence which is very likely

to come into play when the subject of the experiment expects, as he probably would expect in experiments with alcohol, to find a definite stimulant effect. To avoid this possible cause of error, Rivers adopted the plan of administering alcohol in a mixture so flavoured that the subject could not know what he was taking, and in a series of careful observations, carried out on this system, he found that moderate doses of the drug had no appreciable effect, either stimulant or depressant, on the ergographic record. His research, which is the most important contribution to the exact study of this question, would point, therefore, to the conclusion that the supposed increase in the liberation of muscular energy after a moderate dose of alcohol is imaginary, and that the subsequent flagging of energy which has been alleged to result, as a later effect of the drug or as a recoil of the nervous system after the preceding stimulation, is equally imaginary. This negative conclusion is, of course, very much at variance with the impressions of ordinary experience, and on that account it is of interest to inquire how far it is confirmed by evidence obtained under conditions less artificial than those of laboratory experiment. With this object I have recently made some investigations to test the effect of alcohol on the output of factory operatives. And though the inquiry was only of a tentative character and very limited in scope, it has given results which are sufficiently clear and consistent to entitle them, I think, at least to provisional acceptance.

Investigations of this kind, I may observe, present rather formidable difficulties. It is not merely a question of finding the suitable man engaged on the suitable work—and the complexity and interdependence of the processes of modern industry limit very seriously the range of choice in this respect—it is also necessary to get the worker's consent to taking a drug of whose nature and effects he knows nothing, and which he is probably inclined to suspect as a "speeding-up" agent; and, what is harder still, it is necessary to persuade him to continue its use even when he does not find it is doing him any particular good. Owing to these difficulties, the number of volunteers who could be induced to enlist for the experiment was very small, and I only succeeded in obtaining records that could be regarded as at all adequate in the case of twenty subjects: four men working at the Drop Forges, two men doing other fairly heavy manual work, nine men engaged on shell-boring, and five girls engaged on copper-band turning. The details of the experiment varied somewhat in the several groups. The shell-borers and the copper-band turners had a single dose of alcohol—1 ounce to $\frac{3}{4}$ ounce of rectified

spirits in the case of the men, $\frac{1}{2}$ ounce in the case of the girls—this dose being given early in each shift during the alcohol period, and the workers' average rates of output in that period were compared with their output under ordinary conditions. Throughout the experiment the spirit was given in a flavoured mixture, which sufficiently disguised its taste to persons who had no reason to suspect that they were getting alcohol. The same mixture, but without alcohol, was also given as a control test during a number of day-shifts. In the case of the other subjects—*i.e.*, the men on heavier muscular work, who were all working on day-shift—variations were made in the experiments by administering the alcohol at periods of the working day which differed in the several series of days over which the tests were continued, and also in some instances by giving the drug twice in the day.

The maximum dose of alcohol given in these tests—*viz.*, 1 ounce of rectified spirit—is about equivalent to 3 ounces, or rather more than a large glass of whisky, at 40° under proof, and would correspond to something over a pint of light beer of original gravity 1,042. This quantity is in excess of what is usually taken at a single dose in industrial drinking, so that it may be regarded as adequate for the purposes of the experiment. I may add that it was found to be quite sufficient to produce definite subjective effects, which, indeed, in some cases, were so pronounced as to necessitate a reduction of the dose.

The results of the various experiments are summarized in the Tables I. to VI., showing results of experiments to test the effect of alcohol on output of munition workers. I think you will agree in the general conclusion that the figures fail to show any evidence whatever that alcohol influenced, either favourably or unfavourably, the output of any of the subjects. The differences which appear in individual cases between the work done in the alcohol periods and in the non-alcohol periods are in every instance so slight as to fall well within the range of merely casual fluctuation, and they show no sort of constancy in their direction. Take, for instance, the figures in Tables III. and IIIa., showing the output of the two men working on the forging of rifle barrels. One of these men (Subject No. 1) has a higher average output when he goes on alcohol than when on the control mixture, or during the normal period before the commencement of the test, and this fact might be taken as evidence of a stimulant action of the drug; but such an idea is negated by the still further rise in energy in the normal period at the end of the experiment. And it is further contradicted by the results shown in Table IIIa.,

from which it will be seen that this subject's output is relatively better in the afternoon, during the period when he has his alcohol in the morning, and better in the morning, when he does not have his alcohol till the afternoon—a fact which, if it were due to anything more than merely casual fluctuation, would suggest that the drug had a directly depressant influence. In the case of the other subject, where the differences in the hourly rate of output during the several periods of the test fall within a smaller range, the absence of an alcoholic effect is even more clearly apparent. Again, in Table IV., referring to two other men working in the Drop Forge shops, we see that one of them does slightly better in the alcohol period, increasing his average output by 3·6 per cent., while the other does slightly worse, his output being 2·9 per cent. below that in the non-alcoholic period—in both cases. The differences are, I think, clearly too slight to be significant.

A similar negative result is found in the case of the shell-borers, as shown by the figures in Table V. If we take in that table the averages calculated on the figures of four shifts and upwards, we find that on the day-shift two subjects did better on alcohol than on control or without any mixture, and five did better on either control mixture or under normal conditions than with alcohol. And on night-shift—where the comparison is only between alcohol and normal conditions—three did better with alcohol, and one better without. The differences, however, are in all cases too slight to be significant.

The absence of drug effect is further confirmed by the fact that two of the patients, whose output on day-shift is higher either with control mixture or under normal conditions than with alcohol—viz., Nos. 2 and 7—give better results on night-shift when taking the alcoholic mixture. If we consider also the averages based on a smaller number of shifts, the figures show the same inconsistency. The ordinary habits of the individual subjects with regard to alcohol did not seem to exercise any influence on the result. Of the two teetotallers among the subjects, one (No. 4, day-shift only) did better on alcohol than without, and the other (No. 9) did better without alcohol on the day-shift, and with alcohol on the night-shift, as did also the one definitely alcoholic subject, No. 7.

It might, perhaps, be objected that the reason why these figures fail to show an alcohol effect is because they are based on the output over periods of several hours. If there had been an initial stimulation followed by a counter-balancing depression of energy, the result would obviously be very much what we see.

An hour-to-hour measure of output is so difficult under factory conditions, and is so liable to arouse suspicion of a speeding-up design, that it does not appear practicable to attempt it on any large scale ; but, as you will see from Tables I. and II., I succeeded in arranging something approaching to it with two subjects, and the results go to show that there is no foundation for the speculative objection I have mentioned.

Thus, Table I. gives the output, at short intervals, of two hours of a man working on cable-drum rivetting, who during one week had alcohol at 3 p.m., and during another week at 9 a.m. You will note that in his case the distribution of output over the several periods of the day shows very little change from one week to another, and such fluctuations as there are do not occur in any special relation to the alcohol dose. And in Table II. there is a similar absence of any trace of the drug having caused any variation in the subject's speed of work.

The results obtained in this inquiry are, then, of a quite definite and consistent character. And, confirmed as they are by the ergographic researches of Rivers, they may, I think, be taken to demonstrate—not indeed as a fact, but at all events as a probability to be established by further experiment—that alcohol has no objective effect on muscular work, that it acts neither as a stimulant nor as a depressant of muscular energy.

If this negative conclusion is to be accepted as true, it follows that the use of alcohol in industrial drinking is wholly to be accounted for, so far as purely drug action is concerned, by the effects which it produces on the sensations and the emotional tone of the drinker. These subjective effects of the drug are, of course, familiar knowledge, and it is not to be expected that the experiments to which I have referred will have elicited any novel facts concerning them. None the less, certain data obtained in the course of the tests are worth noting for the clearness with which they illustrate the bearing of this specific action of alcohol on the genesis of industrial drinking. Of special interest from this point of view is the evidence which the factory results give regarding the duration of pseudo-stimulant effect of alcohol. According to the statements of nearly all the subjects, the sense of increased energy and efficiency produced by the drug did not last above a period of between two and three hours, after which time the need of a further dose was felt. In this fact lies the explanation of the dependence of industrial drinking on frequent access to liquor. When such access is not to be had, so that the pseudo-stimulant effect of a single dose of the drug would be

overshadowed by the subsequent sense of depression, or, at all events, of relapse to the previous level of feeling, the disadvantages of alcohol are sufficiently evident to the worker to prevent the growth of a drinking tradition. That is why industrial alcoholism has never developed amongst coal-miners.

Another important point which was brought out very clearly in the factory tests is the degree to which the workers' appreciation of the subjective effects of alcohol is related to the nature and conditions of their work. Thus, the men employed in the Drop Forge shops, where the labour is of a very strenuous kind, and is carried on in a hot and unpleasant atmosphere, were far more emphatic than the others in their testimony as to the benefit derived from the alcohol mixture. They recognized its distinctive effect, and were quite clear that the control mixture, though commended to them as an equally powerful tonic, had no such action, and, indeed, gave no relief whatever to their sensations of fatigue. On the other hand, the subjects who were doing lighter work—for instance, the shell-borers, though they, too, found that the alcohol mixture gave them a feeling of increased vigour and well-being, were much less positive on the point, and several of them thought that the control mixture had quite as good an effect.

The fundamental reason for the use of alcohol by the industrial drinker is, then, its narcotic influence, its power of relieving the sensations of fatigue and discomfort, and of dulling the perception of unpleasant conditions. In brief, its action is that of an industrial anæsthetic; and it may be remarked in passing that it is by reason of this action that it has in the past contributed in an important measure to perpetuate bad industrial conditions. It has helped the manual worker to tolerate what ought to be intolerable—to put up with excessive hours of labour, with an inadequate standard of dietary, with defective ventilation of workshops, and with other violations of sound hygiene. That has been its recommendation to the short-sighted employer and to the ignorant workman; and even to-day it is possible to find instances where needed reforms are delayed because master and man are at one in believing that a pot of beer is a sovereign remedy for the unpleasant effects of a dust-laden atmosphere.

Thus far we have been considering industrial drinking solely from the point of view of the drug action of alcohol. But alcohol is not merely a drug; it is also a food, in the sense that by its combustion in the body it can supply part, and, indeed, a considerable part, of the energy needs of the organism. Thus,

though, as we have seen, it has no true stimulant action, though it does not assist in the *liberation* of muscular energy, it does act as a *source* of such energy, just as do the fats and carbohydrates of our ordinary diet.

This fact is of great importance in relation to industrial drinking, for it means that the worker who has recourse to alcohol, primarily for the sake of its drug effect, will obtain into the bargain a substantial amount of fuel food, and is thus able to reduce proportionately his intake of other forms of nutriment. Naturally this is a consideration of some weight with the ill-paid worker; and it is, of course, in the lower ranks of unskilled labour, where wages are relatively small, and where economic conditions generally are unfavourable, that industrial alcoholism is most prevalent. We are dealing here solely with the *causes* of industrial drinking, and not with its *consequences*; but, to avoid any risk of misconception, I think it may be well, before passing from this subject of the food value of alcohol, to remind you of the reasons why alcohol, though it unquestionably is a food, is a very undesirable kind of food. Unlike the ordinary energy foods of man—the carbohydrates and fats—alcohol cannot be stored in the body in altered and innocuous form, to be drawn upon according to the needs of the organism. It remains as alcohol in the blood and the organs generally until it is destroyed by combustion, and, as this process is gradual, the drug can exercise, when present in sufficient amount and over a sufficient period of time, a gravely deleterious action on the tissues. And that, of course, is why its regular use in industrial drinking is so prone to lead to the morbid changes of chronic alcoholism. These considerations of remoter evil do not, however, come within the narrower purview of the industrial drinker; he knows that alcohol sustains him just as food does, and that it gives him, moreover, an enhanced feeling of energy and well-being. From his point of view it is natural that he should think it superior to other foods, because it is also a narcotic drug, and superior to other narcotics because it is also a food.

We have now completed our survey of the causes which create and maintain the custom of industrial drinking, and it only remains to indicate very shortly how these causes have been counteracted by the restrictive and constructive measures of the Central Control Board, under the chairmanship of Lord D'Abernon. The limitation of the hours of sale cuts off that constant and uninterrupted access to liquor during work, which we have seen to be the root cause of the development of the

drinking tradition. In particular, the closing of public-houses during the forenoon has been effectual in this way, by preventing the worker from starting the day on alcohol; it has thus broken down the specially detrimental habit of the early morning livener, which meant alcohol on an empty stomach. The restrictions on the offsale of spirits debar the industrial drinker from getting liquor in the form most convenient for smuggling into factories and workshops, as used to be done very frequently in the trades of notably strong alcoholic tendency. The prohibition of credit sales and of treating has helped to make an end of those pernicious arrangements by which the publican was enabled formerly to push his trade with the employees of particular factories, with the interested co-operation of the managers or the foreman, powerfully aided by the tyranny of a pernicious social custom.

Finally—and perhaps this is the most important measure on the constructive side—the promotion of industrial canteens, especially in the dock areas, has removed one of the most potent causes of the intemperance of the manual worker by providing him with facilities for obtaining good, cheap, and properly cooked meals.

As a result of these reasoned and co-ordinated reforms, industrial alcoholism in Great Britain is now in the position of a social problem that has found its solution, and a solution, too, that may fairly be regarded as definitive, unless, indeed, we are to suppose that the people of this country will ever be so misguided as deliberately to restore the unregulated condition of the drink traffic which prevailed before the war, and which was the source of such deplorable results to the health and efficiency of the nation.

Table I., indicating the Effects of Alcohol on a Subject engaged in Cable-Drum Riveting.

	7 a.m. to 9 a.m.	9 a.m. to 11 a.m.	11 a.m. to 12 noon.	1 p.m. to 3 p.m.	3 p.m. to 5.30 p.m.
First week (alcohol mixture, rectified spirit, 1 ounce at 3 p.m.) ...	5.37	6.62	6.66	7.15	6.36
Second week (alcohol mixture at 4 a.m.) ...	5.41	6.75	6.50	7.15	6.36
Third week (control mixture at 9 a.m.) ...	5.45	6.79	7.00	7.60	6.08
Fourth week (no mixture) ...	5.50	7.04	6.92	7.55	5.96
Fifth week (no mixture) ...	5.62	6.96	6.66	7.50	6.08

Table II., indicating the Effects of Alcohol on a Subject engaged in Anchor-Plate Drilling.

	First Ten.	Second Ten.	Third Ten.
First week (alcohol mixture after completion of first ten plates).	3 hours 4½ minutes.	2 hours 54 minutes.	3 hours 11 minutes.
Second week (alcohol mixture after completion of second ten plates).	3 hours 5 minutes.	3 hours 3 minutes.	3 hours 4 minutes.
Third week (control mixture after completion of second ten plates).	3 hours 13 minutes.	2 hours 59 minutes.	3 hours 2 minutes.

Table III., indicating Effects of Alcohol on Two Subjects engaged in Rifle-Barrel Forging.

	Subject 1.	Subject 2.
Normal period—before commencement of test	14·3	14·2
Control mixture at 10 a.m. and 3 p.m.	12·8	13·6
Alcohol mixture (1 ounce rectified spirit) at 10 a.m. and 3 p.m.	15·2	14·1
Alcohol mixture at 9 a.m.	14·8	13·9
Alcohol mixture at 1 p.m.	17·1	15·3
Normal period—after conclusion of drug test	18·1	15·4

Table IIIa., indicating the Effects of Alcohol on Workers engaged in Rifle-Barrel Forging.

	Subject 1.		Subject 2.	
	a.m.	p.m.	a.m.	p.m.
Alcohol mixture at 9 a.m.	14·3	15·0	13·7	14·0
Alcohol mixture at 1 p.m.	18·1	16·4	13·8	15·5
Normal period after conclusion of drug test	19·1	17·0	16·9	13·9

Table IV., indicating Effects of Alcohol on a Workman engaged in Forging Handle Blocks.

	Average Hourly Output.
Alcohol period ($\frac{1}{2}$ ounce rectified spirit at 10 a.m. and 3 p.m.)	5.03
Normal period	4.88

Forging End Caps—One Subject.

Alcohol period ($\frac{1}{2}$ ounce rectified spirit at 10 a.m. and 3 p.m.)	11.61
Normal period	12.05

Table V., indicating Effects of Alcohol on Workers engaged as Shell-Borers.

Subject.	Work.	Day-Shifts.			Night-Shifts.	
		Alcohol Mixture.	Control Mixture.	Normal.	Alcohol Mixture.	Normal.
No. 1	18-pound shell	11.5 (6)	12.5 (6)	12.5 (2)	10.1 (5)	12.6 (8)
No. 2	18-pound shell	13.4 (6)	13.9 (6)	12.8 (9)	14.0 (5)	13.4 (14)
No. 3	18-pound shell	11.5 (3)	8.4 (1)	10.0 (10)	9.8 (2)	8.3 (1)
No. 3a	13-pound shell	12.3 (4)	11.9 (5)	11.0 (6)	10.9 (3)	13.9 (6)
No. 4	13-pound shell	15.1 (6)	11.6 (2)	13.8 (9)	—	—
No. 5	18-pound shell	—	—	—	12.9 (3)	11.8 (12)
No. 6	18-pound shell	12.3 (6)	—	14.3 (7)	—	—
No. 7	18-pound shell	9.8 (5)	—	10.7 (18)	10.5 (6)	9.6 (12)
No. 8	18-pound shell	11.2 (13)	—	13.0 (15)	—	—
No. 9	13-pound shell	8.3 (2)	—	10.6 (14)	14.4 (6)	12.5 (7)

NOTE.—(1) Figures in brackets indicate number of shifts from which the average rates have been calculated.

(2) "Shifts under normal conditions" are either prior to or subsequent to the period of the experiment.

Table VI., indicating Effects of Alcohol on Men engaged as Copper-Band Turners.

Subject Work.	Alcohol Mixture.				Normal.*			
	Number of Shifts.	Total Hours.	Total Output.	Rate per Hour.	Number of Shifts.	Total Hours.	Total Output.	Rate per Hour.
No. 1 — third operation ...	7	49	1,047	21·3	7	49	1,016	20·7
No. 2 — third operation ...	7	52½	987	18·8	9	62½	1,305	20·8
No. 3 — third operation ...	4	25	440	17·6	4	28	550	19·6
No. 4 — complete ...	4	19	203	10·6	4	22½	223	9·9
No. 4a — third operation ...	6	29	337	11·6	4	17	207	12·1

* Normal shifts are either prior to or subsequent to the period of the experiment.