VISUAL STANDARDS IN INDUSTRY *

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With the expansion of industrial medical services has come the realization that industry presents many visual problems which have to be faced and eventually solved. So far, although this country has made no unified attempt to deal with the vision of employees, individual firms have done so.

In 1938 the Industrial Welfare Society sent out a questionnaire to its 750 member firms in order to find out whether applicants for employment had to pass eyesight tests and what minimum visual standards were considered necessary. From the replies received from 398 firms, employing about 1,000,000 workers, it was found that most firms do not insist on eyesight tests; and that the many firms who are vision conscious vary in their approach to the problem. Thus while many small firms do not require employees to pass eyesight tests, firms representing the same branch of industry insist on them. A large number of firms, having instituted eyesight tests demand a visual standard of 6/6 or 6/9 in each eye, while other firms are satisfied with 6/12 in each eye.

In this paper an attempt is made to elucidate some of the principles which may guide industrial medical officers in the selection of employees for various jobs in industry. There is no doubt that greater efficiency will be achieved if workers are placed in jobs for which they are best physically fitted. This would eventually be followed by larger output and would in addition ensure the safety of the workers in many branches of industry. But under present conditions of employment a country-wide compulsory medical examination could not be instituted for all workers. Should such an examination be carried out a huge pool of physically unfit would be created whose members would have to be retrained and then placed in suitable employment. This is a big problem which it is hoped will be tackled in the future. A number of private firms have already adopted the principle of compulsory medical examination of new employees and direction of workers into jobs for which they are best physically fitted. This policy, which is ideal if carried out in combination with the training of the physically handicapped, must be put on a sound medical basis.

Ophthalmic Work of the Examining Surgeon

The Factories Act of 1937 provides that juveniles (14-16) should be examined by the Examining Surgeon and an eyesight test carried out. The general examination must be thorough and the Examining Surgeon should be able to refer cases to consultants for special examination. At present he is given no instructions on the visual standards required in the various branches of industry, and in most cases he has no facilities for efficient examination of vision. It is essential that the Examining Surgeon and the industrial medical officer should use a Snellen's test type at 20 feet. Should the vision of the applicant for employment be less than 6/12 in each eye he should be referred to an ophthalmic surgeon. All Medical Boards examining men for war service refer those whose vision is less than 6/12 in each eye to an ophthalmic surgeon for an opinion. The same procedure might well be followed by the Examining Surgeon and the industrial medical officer. The ophthalmic surgeon would then report on the vision of the individual as corrected with glasses. The visual

standards laid down by the Army, Navy and Air Force are based on the vision of the individual corrected with glasses. In special jobs in the Navy and for air crews in the Air Force as well as in the case of drivers of public vehicles (trains, buses and trams) high visual standards without glasses are demanded. For workers in industry the use of glasses presents no handicap and the efficiency of the worker is in no way diminished by their use. On the other hand investigations in the various branches of industry have shown that workers whose vision has been satisfactorily corrected with glasses have suffered from fewer symptoms of eyestrain when engaged at work than the workers who have not had an ophthalmic examination. Any reference, therefore, to the vision of an individual should imply the vision corrected if necessary with glasses.

Suggested Visual Groups in Industry

Modern industry is capable of employing men and women with all grades of vision—from grade 1 with the highest vision, to the partially and even totally blind. The standards of vision required in industry need not be rigid and should vary according to the job. For purposes of classification all occupations can be divided into four groups. In the first group are the occupations which require especially good eyesight such as the very close work necessary in the manufacture of silk yarns, silk hose, inspection and manufacture of electric light bulbs and radio valves, watch making, invisible mending and jewel work. In the second group are the occupations which require normal eyesight. In the third group are those occupations suitable for those with weak eyesight such as cookery, soap-making, gardening and billposting. In the fourth group are the trades in which blind people are employed; brush-making, basket work, piano tuning, massage and physiotherapy and many others.

The following grades of vision are suggested in allocating applicants for employment, whether juveniles or not, to various occupations.

Grade 1 Vision. To this group belong all those possessing 6/6 or 6/9 vision in each eye and also those having 6/6 in one eye and not less than 6/36 in the other eye. Individuals in this group are fit for all occupations.

Grade 2 Vision. Individuals having not less than 6/12 in each eye and also those having 6/12 in one eye and not less than 6/36 in the other eye. Workpeople in this grade are fit for all industrial occupations except for the very close work essential in the manufacture and inspection of radio valves, electric lamps, certain silk yarn trades and a few others. Grade 2 vision is sufficient for all clerical work, the engineering industry and the driving of vehicles.

Grade 3 Vision. In this group are all the one-eyed people who have 6/6, 6/9 or 6/12 in the good eye, and less than 6/36 in the other eye, or who have one blind eye. The one-eyed with 6/6 in the good eye are fit for all occupations, even for those which require fine close work. The one-eyed who have 6/9 or 6/12 vision can be engaged in most trades and industries. Occupations such as coal-mining and certain operations in the engineering trades such as hammering, chipping, turning and milling, present a greater danger of injury to the eyes. It is therefore suggested that one-eyed workers should not be engaged in coal-mining or in any of these engineering operations.

* A paper read to the Association of Industrial Medical Officers, March 24th, 1945.

Grade 4 Vision. To this group belong workpeople who have 6/24 vision in each eye or 6/24 in one eye and 6/36 in the other. People with grade 4 vision can be employed in all outdoor occupations: building trades, carpentry, dock labour, portering and many other like trades.

Grade 5 Vision. To this group belong the blind and partially blind and can include all individuals with less than 6/36 vision in either eye. The National Institute for the Blind has issued several pamphlets dealing with the employment of the blind. They show how, since the beginning of the war, the blind and partially blind have been employed in hundreds of industrial occupations. Some of these are assembling of petrol tanks, crash helmets and ball bearings; bakery work; boot repairing; catering; clerical work; engineering work; and machine operating.

This subdivision of workpeople into 5 visual groups is meant to be a guide only, for the industrial medical officer will often come across workmen with 6/24 vision in each eye doing excellent work in the engineering trades where a higher vision should be required. Vision is only one of the factors necessary in the make-up of the skilled worker. High intelligence and experience often counterbalance the handicaps which arise from poor visual acuity. Such people should not be turned away from their jobs, for in the selection of the right man for each job the total mental and physical make-up of the individual should be the guide.

Close Work

Fine work at close range presents a special problem in industry. Radio valve manufacture, electric lamp inspection and manufacture, fine weaving and silk hose manufacture necessitate working at 10 inches or even less from the job. This requires constant accommodation effort and convergence to a greater degree than does ordinary clerical work. In the selection of workers for these jobs there should be a full investigation of vision. The visual acuity required is 6/6 or 6/9 each eye. The muscle balance and binocular vision should also be investigated. A Maddox Wing can be used for measuring the muscle balance of the eyes for near vision, and a Worth's amblyoscope is a convenient instrument for estimating the degree of binocular vision (fusion, stereopsis and convergence). Both instruments are small and cheap. Industrial medical officers are not usually fully acquainted with the details and interpretation of muscular imbalance. It is therefore advisable that an investigation by an ophthalmic surgeon be carried out on all individuals engaged or likely to be engaged in such work. Young men and women with a high error of refraction (latent hypermetropia) will often have 6/6 vision but will suffer from headaches when engaged at close work. In all such cases a routine examination by an ophthalmic surgeon would lead to a correction of refractive errors and of muscle imbalance and thus would prevent headaches and eyestrain from which these workers often suffer. As a general rule one can state that individuals with refractive errors, if properly corrected with glasses, suffer no discomfort when engaged on close work. Older workers wearing glasses to correct their presbyopia are just as efficient as younger workers. Investigations of the Industrial Health Research Board¹ have shown that persons engaged in very fine close work suffer from eyestrain which is in many cases relieved by the wearing of spectacles provided with strong prism (base in) to relieve excessive convergence. These investigations have been confirmed and in some factories these spectacles, which are also provided with a magnifying lens, are issued to the workers; but they are not always worn. L. B. Bourne recently reported² on the procedure in careful selection of workers employed in radio valve manufacture which involves close work on very fine parts. Employees are graded according to their distance and near vision, and on the degree of muscle balance of the eyes. Employees who have phorias (exophoria or esophoria) greater than five prism dioptres are not put on fine close work. The adoption of this procedure has been followed by very satisfactory results. Only a very

small number of workers, about 2 per cent., have complained and asked to be transferred to another section of the factory where such fine work is not necessary.

Recent research in binocular vision has shown that not only phorias but also poor stereoscopic vision may often be responsible for symptoms of eyestrain. Ida Mann and Dorothy Archibald³ showed that to be able to continue fine close work without fatigue one should have a well developed stereoscopic sense and good muscle balance for the near point. As a general guide one could recommend that employees engaged in very fine close work should have no hyperphoria. Exophoria or esophoria must not be greater than five prism dioptres. They should have good stereoscopic vision in addition to a corrected visual acuity of 6/6 or 6/9 in each eye. It is interesting to note that one-eyed workers with 6/6 vision in the good eye can continue working comfortably in occupations involving fine close work. This careful selection of workers for fine close work should be done in factories and in training and rehabilitation centres by ophthalmic surgeons with the assistance of an orthoptist who might carry out treatment of individuals with small degrees of muscle imbalance and poor stereoscopic vision.

Myopia

The ophthalmic surgeon is often asked by myopes and parents of short-sighted adolescents whether it is safe for them to carry on with clerical work or any other type of close work. There is no evidence that close work has any effect on the progress of myopia. In the past ophthalmologists held the view that close work caused a deterioration of the sight of myopes (a progression of myopia). Recent investigations have not confirmed this opinion. Myopes whose vision with glasses is 6/6 or 6/9 each eye can carry on comfortably with fine close work (needlework, weaving, etc.). Myopes with 6/12 vision in each eye are fit for all types of clerical work. Adolescents suffering from myopia, whose corrected vision is less than 6/9 each eye at the age of 16, should be advised against taking up close work, as with the natural progress of myopia between the ages of 16 to 25 there is a likelihood of their vision further deteriorating. At the age of 21 they might have 6/18 vision only and find themselves unable to carry on with clerical work or any other type of close work with comfort. The selection of a suitable job by a high myope in adolescence will obviate many years of wasted training.

Latent Hypermetropia

Railway companies insist that employees who are training as firemen and later as engine drivers should have, on entering their service, 6/6 vision in each eye without glasses. Many young men with a latent hypermetropia of 2 or 3 dioptres have 6/6 vision in each eye without glasses, and pass the necessary eyesight tests required by these companies. At the age of 40 their latent hypermetropia becomes manifest and their vision without glasses drops to 6/18. When re-examined at this age their vision is below the required standards without glasses although their vision with glasses is 6/6 each eye. These men are refused promotion from firemen to acting drivers and are given lower grade jobs with loss of wages. The same applies to drivers of public vehicles who are not allowed to go on driving. They have wasted many valuable years in training for a high grade job and at middle age are refused promotion. This could have been prevented had an ophthalmologist examined their eyes before they had taken up employment. The railways and other public transport companies should not employ men who are to be trained as drivers if their latent hypermetropia is 2 dioptres or over.

¹ Weston, H. C., and Adams, S. (1927) Rep. No. 40; (1928) Rep. No. 49.

² Communication to the Industrial Welfare Society, April, 1944.

³ Brit. med. J., 1944, 1, 387.