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MR. HIERONYMOUS: I don't think Mr. Cooper's remarks are all incompatible with what you had in mind, Mr. Chairman. I therefore would like to make a motion that this group assembled here this morning adopt the suggestion you made, and that you, as Chairman of this meeting, communicate our action to these various groups you mention. In other words, the motion would be that the associations and

various groups that operate public buildings cooperate with the National Safety Council and take some actual steps to further safety work in the buildings they represent. I make that a motion.

CHAIRMAN WHISTON: Is there a second?

(The motion was regularly seconded, put to a vote, and carried.)

ADJOURNMENT

Eye Protection

FRIDAY MORNING SESSION

October 11, 1940

The meeting for the discussion of problems of eye protection, which was sponsored by the National Society for the Prevention of Blindness in cooperation with the National Safety Council, was called to order by the Chairman, Dr. Leonard Greenburg, Executive Director, Division of Industrial Hygiene, New York State Department of Labor, New York City, who presided.

CHAIRMAN GREENBURG: The meeting this morning is intended to be a very informal one. We have a chief speaker, but in addition we have a panel discussion which is completely and totally unprepared, the idea being that many of you gentlemen in the audience have had a great deal of experience with eye protection in industry. Some of our experts who have been invited here will discuss various aspects and phases of this problem, based chiefly on questions which have come in to us from

time to time, but it must be clearly understood that anybody in the audience can participate in the discussions as he may wish.

Finally, I want to say that the problem of eye protection in industry does not consist of the gathering of data and doing nothing about it. I am very much reminded of the remark of our dear departed friend, Will Rogers, when he said that data are like garbage: after you collect them you have to find something to do with them, and that is our problem this morning, to find just what we are going to do with these interesting figures.

The first speaker of the morning is Dr. M. Davidson, who happens to be a confrere of mine in New York State and who for many years has been in charge of the eye work for the State of New York Department of Labor.

Industry's Obligation to More Adequately Protect the Worker's Eyesight

By M. DAVIDSON, M.D.

Ophthalmologist, New York State Department of Labor, New York City

There are two aspects to this obligation of industry to safeguard its workers' eyes. One is to make the environment safe for the worker by eliminating hazards causing accidents, and the dusts, fumes, intoxications and poor illumination, responsible for occupational diseases. Safety measures have accomplished much since the turn of the century.

The other aspect, that of making the worker safe for himself, his co-worker and industry, has as yet not received the recognition it deserves. It involves proper vocational guidance and advice for the applicant for employment with irremediable defective eyesight and for the worker who has ac-

quired it in the course of his employment. To reject him as an applicant when found with such a defect or to discharge him after employment, is obviously an inadequate social solution of the problem.

It should be emphasized that errors of refraction are not considered here as constituting true defective eyesight, as long as normal visual acuity can be secured by correcting the errors with glasses. Such errors prevail in more than one-half of the population. When uncorrected, they are of course a handicap and a source of eye strain, particularly under poor illumination.

The true defectives are those with irremediable defective eyesight, either in vis-

ual acuity or otherwise, who constitute the "human" as distinguished from the "environmental" factor in accident prevention and industrial efficiency and who need appropriate attention.

Their handicap may be merely a low visual acuity incompatible with their tasks. It may be, however, a lack of depth perception; defective color vision, congenital or acquired; defective light sense, or defective indirect vision, and accompanied perhaps by a normal visual acuity. They are unable to perform certain tasks effectively and become unsafe in those operations particularly which require speed. Thus, lack of depth perception makes flying and driving any motor vehicle extremely hazardous, and the finer mechanical work and artistic and drafting work difficult. Defective color vision is also a hazard in flyers and drivers and a handicap for signalmen, embroiderers, and in the chemical industry. Flyers, drivers of motor vehicles, sailors, miners and night watchmen need especially good light sense and indirect vision, and photographers and x-ray technicians find their absence crippling.

This group also offers a problem in Workmen's Compensation administration. When they meet with an accident damaging their eyes, they are, in the absence of knowledge of their antedating condition, perforce given the benefit of doubt. We must not, however, exaggerate the extent of their overcompensation. It is balanced moreover by the undercompensation of a considerable element endowed originally with a visual acuity of 20/15 or even of 20/10 for whose loss, when they meet with an accident reducing their vision to 20/20, there is rarely provision under the law. This is obviously not the best kind of justice.

It is clearly the duty of Labor, Industry, State Departments of Labor and other State Agencies to take cognizance of this group of defectives and, for medicolegal justice, of the supernormals, and to come to their relief. Our knowledge of the real size of the two groups, and of the frequency distribution of the causes of defective eyesight in the industrial population, is incomplete. The National Safety Council is at present "unwilling to estimate eye injuries in occupational accidents without further study." Such knowledge, necessary for proper vocational guidance and advice, can be secured, without great expense, by the routine examination of the industrial population by ophthalmologists to screen out the defectives and

classify them as to cause. Merely determining the visual acuity and the mechanical application of eyesight testing methods by non-ophthalmologists are not adequate for the purpose.

A survey of the examinations of eyes for compensation in New York City in 1939, from the vantage point of a rather large material and a uniform method of examination, is presented here. As an introduction to it, let us examine the available data as to the eye capital which the worker brings into industry and the inroads which industry makes on it. Both differ widely between countries and regions, as to whether they are industrial or agricultural, from the presence of endemic diseases such as trachoma. The data also vary with age, due to progress in the art of refraction and correction of its errors, in diagnostic methods, and to better nutrition, all unequal in different localities. It is to be noted that the data are in terms of visual acuity only.

Eye Capital of the Worker

In 1925 Collins' figures for New York, Delaware, North Carolina and Maryland, when analyzed, show among male school children of 16 (less defective than younger boys and girls), with only 10 per cent fully corrected for errors, as follows:

20/20 in either eye, 70.8 per cent.

Less than 20/20 in one eye, 10.7 per cent.

Less than 20/20 in either eye, 18.5 per cent.

Serious defects in the last two groups combined, 8 per cent.

In 1939 an analysis by Blankstein of 920 visual acuity determinations of school children in Chicago, 7-19, to screen out defectives, shows the following:

20/20 in either eye, 68 per cent.

Less than 20/20 in one eye, 22 per cent.

Less than 20/20 in either eye, 10 per cent.

Allowing for a large proportion of defective eyesight correctible to normal by glasses; of other defectives not entering industry of their own choice; and of still others rejected by industry, the eye capital which the worker brings into industry must be considerably better than 70 per cent good eyesight.

New York State Figures

Averages For	Blind	Permanent Partial*	Temporary Disability	Permanent Eye Disabilities % of All Permanent Disability
1925-30.....	8	766	2189	3%
1930-34.....	9	574	1930	2.56%
1934-39.....	8	520	1265	2.74%
In 1939.....	11	467	1190	2.24%

The Present Situation

	Blind	Permanent Partial*	Temporary Disability	Total in Round Figures
Past Annual.....	240	15,600	37,950	54,000
Present.....	80	5,200	12,650	18,000
Annual or on Basis of 20,000,000 workers.....	4	260	632	900
	Per Million	Per Million	Per Million	Per Million

* Includes unilateral industrial blindness.

In 1928 McAuliffe reports defects, some correctable, among 5000, 20.5 per cent.

In 1929 a New York Central Lines survey finds defective, 20 per cent.

In 1933 Murray among miners finds defects, some correctable, 28.3 per cent.

In 1937 Rainey among 15,000, in Chicago found defects, 14 per cent.

Illiteracy among the miners is stated to account for the higher figure, and a rigorous selection by industry since the depression probably accounts for the lower figure. Rainey moreover succeeded in correcting to normal more than half of the defectives and in improving some of the others. True defective eyesight for Chicago today among workers should be accordingly not over 6 per cent.

With due allowance for both the depression and increase of population, the eye toll has been reduced to $\frac{1}{2}$ in 15 years. Available fragmentary figures for the rest of the country indicate a reduction to about one-third for the past three decades. Multiplying the New York State Figures by 10, one can visualize the past and present situation. See table, "The Present Situation."

The following summary of New York City Eye Examinations for 1939 includes

examinations for accidents occurring in 1938 as well as in earlier part of 1939, hence does not cover the same material necessarily shown in the New York State table.

Number of examinations (1 and $\frac{1}{2}$ per person).....3414

Number of persons (7% females; 495 old cases reexamined).....2663

Persons examined for first time (509 subject to reexamination).....2168

A. Persons with normal visual acuity in either eye.....1340

B. Persons with subnormal visual acuity in one or either.....828

C. Persons with permanent partial or total compensable defects.....440

(Non-compensable defectives among uninjured eyes17 per cent

D. Persons with non-compensable pre-existing defects388

(Constitutes in relation to group "A," defective group of.....22½ per cent

The distribution in Rainey's study is upon analysis somewhat as follows: Development, 49%; Injuries, 8%; and Systemic, 43%.

From the data available for the country as a whole it appears that the potential in-

Analysis of New York State Closed Cases for 1939

(On basis of unpublished survey by Dr. Patton, Director of New York State Dept. of Labor Division of Statistics.)

	Number	Total Cost	Average Per Case
Total Cases.....	1,669	\$ 1,074,705	\$ 644 (One death included)
Temporary Disability.....	1,190	49,287	41
All Permanent Eye Disability.....	437	851,613	1,824 (Head injuries included)
Permanent Total Blind.....	11	164,680	14,971
All Other Permanent Disability Cases for Comparison.....	21,381	14,280,252	686

Summary of Distribution of Defects of Group "C"

Less than 20/40 in one or either eye	20/40 to 20/100 in one or either eye	20/100 and less in one eye	Blind
41.6%	23.5%	33.5%	1.4%

dustrial worker may bring with him into industry an eye capital about 30 per cent defective. A large proportion of these defectives are remediable by glasses. Among the industrial population the incidence of true defectives is somewhere between 14 per cent and 22.5 per cent, or approximately 18 per cent. About 1/12 of this group is defective because of industrial injuries in the past.

On the basis of a vision of 20/100 or less, and of lack of binocular depth perception as constituting the group of serious defectives, there are 6 per cent of serious defectives in the industrial population requiring special attention in view of the National Industrial Defense Program, for the sake of efficiency and of accident prevention. Over one-third of this serious defective group is a hazard because of lack of binocular depth perception, and possibly a hazard out of proportion to the numerical strength of the group. In any survey of the industrial population it is therefore extremely desirable to make a complete eye examination, to include the other elements of normal eyesight and not merely to measure visual acuity, as is commonly done.

Eye Examination Program

A survey of the incidence of true defective eyesight among the industrial population in terms of its most important element,

visual acuity, indicates about 14 per cent to 18 per cent, with most probably less than one half serious, defectives. The problem appears therefore smaller than it is usually envisaged, but it nevertheless calls for better knowledge of it, and, above all, for attention.

As part of the Defense Program, now acute, and for the sake of a more just administration of Workmen's Compensation, a complete study of the problem with a view to meeting it is in order. Neither industry nor labor can be expected to carry it out with satisfaction to all concerned.

Considering that some 10 per cent of workers of New York, and presumably elsewhere, are annually examined or have a hearing at a Department of Labor for compensation for all kinds of accidents, entailing loss of time by the worker and expenses by the State, utilization of the occasion and the facilities of the Department for the examination of the eyes of these 10 per cent, already there for other purposes, suggests itself as practicable and economical.

These eye examinations, not for glasses, but to screen out the defectives for vocational guidance and advice, would entail for the country no more than adding or attaching to State Departments of Labor some 150 ophthalmologists to perform the service, and a certain number of medical social workers

Summary of Causes and Distribution of Defects of Group "D"
(An Attempt at a Classification of a Sample of 55%)

	Better than 20/100	20/100-20/200	Stereopsis Loss	Blind
Developmental—47%				
Errors of Refraction.....	28.2%	7.5%	3.2%	0.5%
Strabismus.....	2%	1%	3.1%	
Miscellaneous.....	1%		0.5%	
Injuries—21%				
Old Industrial.....	4%	2.5%	1%	0.5%
Non-Industrial.....	6%	3.5%	2%	1.5%
Systemic and Unknown—32%				
(includes senility, infections, glaucoma and simulation).....	25%	4%	3%	
Total 100%.....	66.2%	18.5%	12.8%	2.5%

to be furnished by cooperating State agencies, such as the State Departments of Health, of Social Welfare, and of Education. The execution of the program could be lodged either with a Workmen's Compensation Division or with an Industrial Hygiene Division.

The program could be expanded, should the need arise, to examine a larger sector of the population by increasing the staff. It

can also be adapted for the general physical examination of workers. It should be borne in mind that the mere determination of visual acuity, forming part of physical examinations in general, is of no use, since low acuity may be due to errors of refraction only, and normal acuity accompanied by defects or disease.

The cost involved might be one-tenth of what it would otherwise be.

The Panel Discussion

CHAIRMAN GREENBURG: It is interesting that in a state such as the State of New York—and I use that just by way of example—we have a total of approximately 3,000 eye accidents a year, that at least one or two of these each year result in death, that about ten or fifteen result in permanent total blindness, permanent total industrial blindness, that about 500 result in permanent partial disability, and that there are a large number of temporary disability cases. This must be characteristic of practically all manufacturing states in the union, and a very recent, most interesting and valuable report which has come in from the state of Wisconsin, proves this to be essentially the fact.

These cases in New York cost about \$1,200,000 a year in round numbers, a fairly sizeable sum, and the average per case is approximately \$650. When we looked into the cost of some of these accidents we found

that in general handtools were associated with higher costs than some of the flying objects. In other words, in many cases of small flying objects the disability is not great and not serious, but as soon as a tool begins to come into the picture, usually the flying object presents a more serious hazard. The average cost per case is just about as Dr. Davidson presented to you, about \$650 for an eye accident and about \$350 for other types of accidents.

The Problem

The problem then boils itself down to a real economic and social problem because of the economic factors involved—to industry and the workman in the case of the injury, and to society in general in the case of those persons who are permanently and totally disabled or who are partially disabled on a total basis.

That means that a broad-gage plan must be set up, both with reference to protection of workers and compensation for eye injuries and more particularly for standards of employment rejection. Now some companies have a very broad-gage policy along these lines and they do not refuse employment to a man because he has no vision in one eye, but unfortunately some companies do refuse employment to such a man and it brings about therefore a most serious problem.

These and other problems which you may have in mind, and which some of our friends have had in mind, can be discussed very freely and frankly before this panel. I will now present to you Mr. W. T. Cameron, Chief Safety Advisor, Division of Labor Standards, U. S. Department of Labor, Washington, D. C., who will be the leader in our panel discussion of eye protection problems.

(Mr. W. T. Cameron assumed the chair.)

The Panel Members

Chairman Cameron introduced the members of the panel as follows:

Mrs. Eleanor Brown Merrill, Executive Director, National Society for the Prevention of Blindness, New York City.

Harry Guilbert, Director, Bureau of Safety and Compensation, The Pullman Company, Chicago.

Dr. T. Lyle Hazlett, Medical Director, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

R. McA. Keown, Engineer, Industrial Commission of Wisconsin, Madison, Wis.

M. A. Kroger, Director of Safety, Chevrolet-Gear, Axle and Forge Division, General Motors Corporation, Detroit.

H. S. Simpson, Safety Director, Caterpillar Tractor Company, Peoria, Ill.

CHAIRMAN CAMERON: As I see it, we have before us two problems. One is protecting the good eyes of industry, and there are a lot of them still left despite some of the figures that do turn up on lack of depth perception and lack of visual acuity

and color blindness; and so on. We have the job of keeping the eyes for our great defense program, and so on. The second problem is: How are we going to make the best use of these workers who now have some uncorrectible defect? Where can they be placed? Where can they be used? How shall we provide them with opportunities to earn a livelihood?

I think Mr. Knudsen said the other day that our first bottleneck in national defense is going to be the lack of skilled and trained workers, so we are going to have fewer of the labor supply waiting outside the gates, clamoring to get in, and we are going to have to use some of these people who have previously been screened out of industry or neglected because of some defect, in many cases a visual defect.

We are going to follow the questions as listed in the program, although we probably will do some skipping around.

First, in what operations and occupations do eye injuries occur most frequently? I shall call first on Mr. Keown to give us some information on that subject.

Where Eye Injuries Occur

R. McA. KEOWN: Mr. Chairman, I have a few figures. I am not going to give very many of them because they have been covered pretty well already, but some of the most important.

In our Wisconsin eye injury cases we find that the industries that cause the greatest number of injuries are the clay, glass and stone industries, and another important group is the metal and metal products. The paper and paper products contribute only about 2.4 per cent of all the eye injuries. Another group, a rather serious one, is the commercial and mechanical services like garage work, which account for 4 per cent of all of the eye injuries. As to mechanics, carpenters suffer more eye injuries perhaps than any other group, and hammers contribute the greatest number of injuries as a tool. Dr. Greenburg mentioned the fact that in Wisconsin 23 per cent of all of the eye injuries are caused by handtools; yet only about 4 per cent of the benefits are paid on account of handtool injuries.

Eighty per cent of all of our injuries are of a temporary nature, and manufacturing contributes only about 50 to 55 per cent of

the eye injuries. Eighty-three out of every 100 compensable eye injuries are temporary. As stated by the New York figures, our number of eye injuries as compared with all injuries runs from 29 per cent to nearly 4 per cent. That figure has varied between those two limits for quite a number of years, and the amount of benefits paid, however, runs from 8 to 10 per cent and that checks very closely. The cost of eye injuries in total benefits is about two and one-half times as serious as for all injury cases.

CHAIRMAN CAMERON: I think we might have an actual example or two. I know that the usual procedure in industry is to go through the shop and make a list of all the jobs where eye protection of one kind or another should be furnished. I should like to call on Mr. Simpson, of the Caterpillar Tractor Company, to give us some examples of where eye cases turn up in heavy manufacturing.

H. S. SIMPSON: It is our experience, and that of all industry, that accidents happen where you do not expect them. If you do not expect to have an eye injury, you do not wear goggles, and you end up in the hospital with an injury and then the compensation. We have considered adopting the compulsory goggles rule but we get up there and then we back away. We have tried to evaluate hazards. We say that the operator on this machine must wear goggles, but what are we going to do about the timekeeper who stops by for an instant to get the man's time and also one of his chips?

Our serious eye accidents have been cases, for instance, where a lock-washer exploded when the nut was being backed off with an air wrench. A piece of the lock-washer tore a hole in a man's eyeball. Normally, you have a devil of a hard time selling the man in the shop that there is any particular hazard there, but he believes it now. Incidentally, he is in our employ and we do not feel that we should discriminate against his lack of binocular vision. The intelligence level there takes care of many things. He has learned an awfully good lesson and he sees twice as fast with one eye.

FRANK K. BOYLE (Brown-Lipe-Chapin Division, General Motors Corp., Syracuse, New York): In the doctor's statistics, how many cases involved syphilis and do accidents aggravate the condition?

CHAIRMAN CAMERON: Dr. Davidson, will you take that question?

DR. DAVIDSON: A very insignificant proportion. I haven't the exact figure.

MR. BOYLE: Is it true, doctor, in the state of New York that if a person has syphilis and an accident aggravates the condition he gets compensation for total blindness?

DR. DAVIDSON: According to our laws, if syphilis preexists an accident, he gets paid for the loss regardless of the pre-existing condition. Aggravation is a ground for compensation.

Getting Employee Cooperation

CHAIRMAN CAMERON: I think this very logically leads us up to "The pro and con of the compulsory goggle rule." We have had several questions turned in. The first one is, "Any eye protection campaign depends on the worker. How do you gain his cooperation? What is the supervisor's place in the program?"

Dr. Hazlett, I should like to have you tell us a little about how you gain the worker's cooperation in wearing goggles. Now we have two things here. We have one the matter of making the wearing of goggles a condition of employment, just like punching a time clock or anything else. We have the other problem of a selling campaign to get the workers to wear goggles voluntarily with perhaps a little pressure now and then from the supervisor. Will you take that first, Dr. Hazlett?

DR. T. LYLE HAZLETT: In regard to the employee, I think that we can educate him by means of example. It has a very telling effect. We all feel that a great majority of the eye accidents can be eliminated if we do have proper protection. We still, of course, have the timekeeper or the engineer who may have an accident when walking down an aisle, but eye accidents can be eliminated by making the employees more conscious of the effects of simple eye injuries.

Often if the employees are shown a break-down of minor accidents occurring in different divisions, it will make them realize the size of this whole problem. I think we can sell this to employees by gradual education, making them more conscious of the number of cases occurring during a

period of time. This must be continuous. By keeping after it all the time we feel that we can create a great deal of additional interest in the conservation of eyes in industry.

Goggle Difficulties

S. WARZALA (Calco Chemical Division, American Cyanide Co., Bound Brook, N. J.): In our experience, there is no difficulty with the worker about the wearing of goggles. The worker will wear goggles whenever we can furnish him a satisfactory goggle, but I do not know of any goggle manufactured today that you can call a satisfactory goggle for our purpose.

Where you can wear a spectacle type of goggle and where you can wear a cup type goggle, perforated to provide ventilation, you may use that goggle very well; but where you must have a goggle that covers your eyes completely and have it practically hermetically tight, then we do not have a goggle on the market that will satisfy that condition.

We have eye accidents in industry largely because men cannot wear goggles all the time, and they cannot see in connection with their work the different places where they are required to wear goggles; therefore, they get into trouble.

In one case we had a drum standing on end, covered with a removable top. In the top was a hole about two inches in diameter. Liquid caustic was kept in this drum. The rod with which they mixed this liquid caustic was not available. An employee, wearing glasses like my own and having only one good eye, found a piece of pipe a half-inch in diameter. The pipe was about 45 to 46 inches long. The drum was about 40 inches high. He struck the pipe into the drum. On the bottom was about two inches of this caustic. A crust had formed on top. As the pipe struck the bottom a drop of acid, believe it or not, flew through the pipe and under his glasses and into the good eye—mind you, into the good eye.

I will give you another example. A man again was handling caustic wearing rubber goggles. They were rubber goggles that covered the eyes. Under one of the eyes there was an opening of about one-eighth of an inch. A drop of acid found that opening, lodged in the eye and produced an injury.

We communicated with the manufacturers of the goggles. They showed great interest and as a result they are trying a new experiment; they have sent us four goggles of different designs. We have tried them on 100 men. Seventy-five men were able to use one of those goggles so that they covered the eye completely. The others required other fits.

Now even in the fitting of goggles there hasn't been much progress; all of the goggles seem to be poured out of one mould, and if they do not fit, well, it is just too bad. The reason the workmen do not wear goggles is because there are no goggles that they can wear eight hours a day and do any work and under the circumstances we certainly cannot require it.

I should like to see a goggle produced that a man will be able to wear all day long and have complete protection, not only against flying objects but also against corrosive liquids and materials.

CHAIRMAN CAMERON: Has anyone had any experience in relation to eye protection for the man who is handling acids and caustics?

MR. BOYLE: I think that problem also involves the Interstate Commerce law. When empties are shipped, if there is anything in those empties and the truckman suffers an eye injury, the concern that is shipping them back is involved.

CHAIRMAN CAMERON: That is a very good point, the legal responsibility of the company shipping the containers.

EDGAR N. GOLDSTEIN (Consulting Safety Engineer, San Francisco): I think that the idea of having one type of goggle that is going to do for every industrial condition is expecting just a little too much. You cannot do that any more than you can give a carpenter one tool and have him do all the carpenter work that is necessary. However, some of the manufacturers make goggles with different nose bridge widths and if they are properly adjusted a man can wear a pair of those spectacles all day, just as easily as he can wear a pair of ordinary spectacles that he may require on account of his eye condition.

I want to ask if the present trend is toward 47 millimeter instead of 50 millimeter in order to afford better fit?

47 or 50 Millimeters

CHAIRMAN CAMERON: The question is whether in the use of industrial spectacles the 47 millimeter, which is the smaller size, the more or less standard size, is better from an optical standpoint, although perhaps not so good from a safety standpoint? Mr. Guilbert, will you answer that question?

HARRY GUILBERT: Your question is a very good one. I am going to ask an expert to answer it, if I may. Dr. Davidson, of the Pullman Car Works, will you come here for a moment and answer the gentleman's question?

DR. H. P. DAVIDSON (Pullman Standard Car Manufacturing Co., Chicago): It depends entirely upon the size of the man's face. Of course, you can decenter any lens, but you have to take into consideration the build of the man. For instance, when you have a very small, wizened man, if you put a 50 millimeter goggle on him, his goggle would stand out like wings, so in that case you would have to put on the 47. If you have a man with a large face, then you would put 50 or even larger on him.

MR. GUILBERT: I think that Dr. Goldstein made a very good point there about a carpenter doing a job with one tool. I think that most of us realize that there are hundreds of thousands of men in America today wearing goggles all day long. In our particular organization there are 25,000 men and women wearing goggles eight hours a day. That is the answer. Of course, it is impossible to make one goggle to suit every occasion. I think that Walter King will bear me out on that, and he has had a great deal more experience along those lines than I have. We worked together on the problem over twenty years ago. But today, let me repeat, that in our particular case every man and every woman wears goggles while they are working.

If a visitor comes to the plant he protects his eyes or he doesn't get into the plant, and I mean superintendents, vice presidents, foremen and everybody else. There is a sign at the entrance to each plant, signed by the president of The Pullman Company, that eliminates all arguments from some of these wise guys who come along and want to get into the plant without glasses. Personally, I have had more trouble with the

so-called executives than I have had with workmen.

I am not an expert, but you can put my subject in a nutshell. It is preventing eye accidents. And the only way to do it, in my opinion, is to get every man in the shop to protect his sight, because there is not a man in this room or anywhere else who can lay down a set of rules and say that accidents are going to happen here or they are going to happen there or they were unexpected. Well, management, of course, is supposed to be intelligent enough to take care of the unexpected situations.

I want to bring out one very important point if I may. It is this: To get men to take care of their sight we must render a service to them. When you take an automobile to a service station the attendant does everything but brush your teeth. Now in the average plant in America there is a tool room where men turn in their tools, but in this average plant where men are given eye protection the management leaves it to the men to take care of their eye protection and the men do not do it. That is what I call "individual control." You must substitute central control.

Let me illustrate briefly. I took a tour through one of our shops the other day where there are 1,700 men and I scrutinized very carefully every man whom I passed. I was in every department. I did not see one of the 1,700 men without goggles. Every pair of goggles that I looked at fitted the man and were clean. Why? Because those men have the privilege of going to what we call the goggle and respiratory dispensary, any time of the day and night, to get what in my opinion is the crux of the whole thing, and that is a proper adjustment. When you buy a pair of glasses—and lots of the men here are wearing glasses—what is the first thing that is done for you? They are adjusted, aren't they, and they are continually getting out of adjustment. Even the fellow's in the office. Now what chance do you think the man in the shop has of keeping his goggles in such condition that they fit him properly all day long? He hasn't.

MR. BOYLE: Mr. Guilbert, who adjusts the goggles in your organization?

MR. GUILBERT: A full-time man, and he is doing a very excellent job. I could prove that to you better if you could talk to some of the men and find out how they feel

about it. It is very unfair, I think, to expect 5,000 men in a plant to be very happy about wearing goggles all day long and do a good job if you do not render this service that I am talking about.

"Cafeteria" Service

CHAIRMAN CAMERON: I think maybe we have another answer here to that same question while we are on it. Mr. Simpson, of the Caterpillar Tractor Company, I think has a cafeteria wagon that goes around and fits goggles. Will you tell them about that, Mr. Simpson?

H. S. SIMPSON: We have the problem of some 160 or 170 acres of property, of which 70 acres are covered with buildings. There is a lot of walking involved. We pay people to work, and if they are in the back end of the shop, we figured that we could save money by using a push cart, like one of those ice cream carts, with a lot of disinfectants, etc. That cart is in circulation in each division continually on each shift. The operator of a cart goes right down an aisle and stops and talks to the machine operator, or whoever the person might be. One of those service men will cover from 100 to 150 employees per shift. There are five people doing that. It means that I continually have my hands on the focal point of that many conversations with that many employees. There are a lot of duplications, but it gives one a very good opportunity to know what the feeling is on certain things. It gives you a rather rapid return on the fittings.

On this fitting proposition and on prescription glasses, our safety glasses do fit very definitely into the program, but they themselves are not the total answer. The goggle manufacturer cannot make brains for your men.

Wednesday night five of our executives flew in here, and the top man of the group had his safety glasses on. He had gotten 155 miles away from the plant and had not thought of them yet—so they must have hurt his eyes very much. In decentering, we have an overall geometric sign through the center of the lens and quite often we can decenter two millimeters each way. We like to go a little to the outside, but if we go too far, on the second shift where we have artificial illumination we get back lighting

which gives you more trouble than anything else.

CHAIRMAN CAMERON: We haven't answered your question yet; we are still hoping that we may get the answer.

MR. WARZALA: I know that, Mr. Chairman. I think that in any intelligent discussion of the goggle question, we ought to make some distinction between goggles that are used in plants where corrosive liquids are handled and plants that do not handle them. On the train coming to Chicago I heard about an interesting accident. An office girl was sitting down doing her work, and another girl standing in back of her was handing her a piece of paper. In taking it, somehow the sheet of paper hit her eye. It came right across the ball of the eye. The girl naturally blinked her eye and continued working and did not report to the medical department that day. She reported the following day and by that time infection had set in, and I understand that the girl right now is in the Eye and Ear Hospital, in New York City.

When you are handling corrosive materials the plain eye glass kind of a goggle will not do. Neither will the cup goggle with ventilation, that is, with screens, baffles or other things. We have used the nod-and-shake goggles, but there is a complaint against them. It is a small goggle that fits tightly over the eye. The frame is filled with water. When the goggle fogs up and you cannot see, you just shake your head and the water in the goggle washes it off. There is distortion of vision, headaches, and a lot of other things. Now these rubber cup goggles cover the eyes completely, but they are not satisfactory. So in any discussion of goggles that anybody makes, I should like to see a distinction drawn. Let us talk about goggles for non-corrosive materials and goggles for corrosive materials.

Suggested Committee Study

CHAIRMAN CAMERON: Let me ask Mrs. Merrill a question. Would it be possible to set up a technical subcommittee within the National Society that could study this problem during the year and report back to the Congress next year, or if there is a report in the meantime, could it be made available to the National Safety Council?

MRS. MERRILL: I think, if we can have the cooperation of our Industrial Advisory Committee and of the Safety Directors, that it would be possible through the National Society to carry a clearing of that information and to assemble material.

CHAIRMAN CAMERON: How does that sound to you folks in the audience?

MR. BOYLE: I was in the Willis Morrell plant at Elmira to get the result of an eye survey. This was prior to the time they made physical examinations of employees. A number of accidents had occurred and they found that two employees were totally blind in one eye and did not know it. I will ask the lady if she has ever had that experience.

MRS. MERRILL: I think for that particular question, the leader of the discussion might want to ask someone else for an answer.

CHAIRMAN CAMERON: Yes, I have quite a few questions just on physical examinations and how much stress should be laid on the eyes. Let's try to settle this equipment problem if we can. Is there anybody in the audience who has made a home-made goggle or something else that answers this causic and corrosive problem?

Mining Experience

A. AMRAM (Hamlin & Co., New York City): We have been discussing eye protection for various industries, and I dare say the industry in which they have more accidents than anywhere else is the mining industry. According to Dr. Davidson, 28 per cent have defective vision, a larger percentage than in any other industry.

I should like to go on record as saying that I do not quite agree with the comment that this is perhaps due to inferior intelligence. In my work, which takes me to a few mines—I am not a mine inspector but nevertheless it is one of my duties and I am referring to southeastern Missouri, to Utah, and Nevada—I find that the miner is just as intelligent as any industrial worker.

We have the greatest difficulty, especially out in the western mines, to get the proper type of protection. I might perhaps illustrate that by a letter I have just received from a mine superintendent who is out in California. He says:

"Referring to our conversation in regard

to making our men wear goggles, we wish to speed this matter all possible. We just had another very bitter experience; one of our men had a little dust in his eye and the local doctor treated it for about ten days."

I might say that we are eighty miles away from any doctor, or at least from any eye specialist. The letter continues:

"As he did not improve, we sent him to a specialist and he reports that the man will have permanent impaired vision; probably due to improper treatment. As we told you, 60 per cent of our accidents are eye trouble caused by dust and if we can find goggles that can be worn underground without fogging we want to start using them at once."

Well, I thought of a friend of mine, a superintendent of a mine, who had had a great deal of trouble getting the men to wear the right type of goggles, but he finally thought that he had solved the problem; so I wrote to him so that I could inform our mutual friend in California what he had done. This is what he says:

"At one time we thought we had solved the problem with a certain type of glass goggle, but it turned out that due to certain air currents and conditions these goggles only worked satisfactorily in one place. With the same men wearing the same goggles and being transferred to another part of the mine, the glass fogged up immediately and it was impossible to use them successfully.

"These glass goggles are much more satisfactory where there is a perceptible movement of air, as it seems to take care of the fogging.

"We still use in most cases a very crude wire goggle, which you are perfectly familiar with and we all consider very crude."

DR. M. DAVIDSON: Mr. Chairman, may I say that I did not mean to reflect on the intelligence of miners. I used that word because Mr. Murray, who reported his findings, explained the eye incidence among miners on that basis and I was just quoting him.

A. H. TRESTRAIL (Pickands, Mather & Co., Caspian, Mich.): I have been in mining about twenty-one years. When we first started out we had the goggle question. We still have it somewhat. At first we tried to get men in certain occupations to wear goggles, and while we saved some eyes that

way, we found out that we lost eyes in other occupations. We finally came to the conclusion that it would be necessary to have every man on the job, whether underground or on the surface, wear goggles.

At first we experimented with the screen goggles, but they were not satisfactory. The argument against the glass goggle was that it fogged. We got away from fogging largely by having proper ventilation in our mining places. The wearing of goggles is the hardest on the supervisor who has to travel from one place in the mine to another. If a fellow is working in a warm place his goggles become adjusted to that temperature and he does not have a great deal of trouble, but the supervisor, the man who goes from one temperature to another, does have trouble. We aim to have our temperature in the mine uniform all the way through, but that is impossible in certain types of mining, especially where you have heavy timber formation or bodies of ore adjacent to sulphur-bearing rock.

We came to the conclusion that a half a loaf is better than none. We do not claim that we are going to prevent anybody from becoming blind; we are not guaranteeing that; but if we can save 90 or 95 per cent of our eye accidents, we are going to do that.

In case of eye injuries, we take our men by automobile seventy-six miles: we just simply put the man in an automobile and take him to an eye specialist. In a group of 600 men, we have had within the last two years two eye injuries where there was a short period of disability. One of them ran as much as fourteen days. We have had compulsory goggle use in our mines now for two years, and in that time the maximum disability has been fourteen days. We haven't had any lost eyes.

In the company's experience in the entire Lake Superior district, where we have approximately 1,200 to 1,500 men employed and our records are interchangeable, I know of only one case that a man had a severe eye injury while wearing goggles.

I have also observed that the man who has to wear goggles with prescription lenses, somehow or other overcomes all the difficulties that these other fellows complain about.

C. A. De MONGE (Kelsey Hayes Wheel Co., Detroit, Mich.): I want to ask Mr.

Guilbert what type of goggle he uses and whether the company pays the cost of furnishing the goggles?

CHAIRMAN CAMERON: The question is whether or not you furnish prescription goggles to your men, and if so, do you charge them for the prescription or do you furnish them free of charge, and what control do you have over them?

MR. GUILBERT: We furnish everything free of charge.

MR. TRESTRAIL: So do we.

MR. De MONGE: Do you use one type of goggle all the way through?

MR. GUILBERT: No, the fewer types the better, in my opinion. We use practically one type throughout the whole organization with very few exceptions.

MR. BOYLE: Mr. Chairman, have you ever heard of a glass eye exploding?

CHAIRMAN CAMERON: Yes, I have. I think that perhaps a number of people who have worked closely with this subject have heard of experiences of that kind. Does anyone want to say a word about glass eyes exploding?

Goggles to Fit

H. B. BENJAMIN: I happen to have had that experience. I can also contribute something about the man who wears glasses and has to wear goggles over them. For eleven years I have worked with goggles over my glasses. I found that the average goggle is not made to fit the average eye glass. You will notice that those in the audience who are wearing glasses all have different style glasses. If every man wore the same style of glasses it would be easy enough for any goggle manufacturer to manufacture a goggle that would fit over those glasses, but that is not the case. So I took a pair of goggles that looked to me as though they were right, took them apart and I ground out and cut those protective sides to fit the glasses that I had. Now when I go to the doctor to have my glasses changed I take the glasses that I wear at the factory, also the glasses that I expect to wear on the street, and I have him make lenses for each pair of glasses. Then I put my sides back on those glasses.

You have noticed that some of them have high nose pieces and others do not. I happened to be foolish enough to buy a pair of those with a high nose piece one time. So I

took a pair of regular goggles and made a leather nose piece. I cut it out so that it fit properly. I do not use those any more because I like the pair that I made out of the other goggles the best; but I loan those goggles to men who want to visit the department.

As to glass eyes exploding, a glass eye is hollow, like an egg shell. There is a certain amount of air in there that gets hot. In fact, if one is in a very hot place, it almost turns to steam. If you step out into cold air immediately where a cold breeze hits that suddenly, it is likely to explode. I have had it happen three times.

CHAIRMAN CAMERON: That is just the kind of practical experience we need. Thank you.

MR. TRESTRAIL: That is a good argument to convince any man that he should wear goggles.

A Study Resolution

ROY S. BONSB (Standard Oil Co., New Jersey): The suggestion was made that this question of the development of proper eye protection should be studied by the National Society. In order to focus the thing, I think it would be well if we could state that it is the consensus of this session that this thing should be studied, possibly through the National Society in cooperation with the National Safety Council, through the Goggle Manufacturers Association, through the Bureau of Standards, and other agencies that are in a position to contribute to the details. I think that should be done because talking is never going to get us anywhere. In order to bring it to a head, I suggest that that action be taken.

CHAIRMAN CAMERON: All right. All in favor of requesting that this group go on record as requesting that the National Society for the Prevention of Blindness, in cooperation with the National Safety Council and the Bureau of Standards and the Safety Equipment Manufacturers Association, set up a technical committee to study types and kinds of goggles for various jobs and that their recommendations be presented before this group at the next Congress, raise your hands. Opposed? It is carried.

MRS. MERRILL: I am glad to have that request.

Job Placement

CHAIRMAN CAMERON: I think that the matter of being seventy or eighty miles away from an eye specialist may be covered somewhat in this next phase of our discussion. "What are the bare essentials that we must know about a man's eyes before job placement?" Dr. Hazlett, would you care to comment on that question?

DR. T. LYLE HAZLETT: I think that most of us are interested in the basic principle of visual acuity, which has more to do with job placement than any other factor. There are a few occupations, of course, where color tests are necessary and also depth perception, but, as a rule, if we have visual acuity we should be able to place a man on such a job that he can carry on without any injury to himself or injury to other workers beside him.

CHAIRMAN CAMERON: There is another question on that same subject here: "To what extent does industry refuse employment to one-eyed men?" Does anyone have anything on that subject? Suppose that a good machinist comes in but he has only one eye? Do you turn him down?

E. F. TINGLEY (United Gas Pipe Line Co., Houston, Texas): We do not hire machinists. We turn anybody down who hasn't good vision to begin with. If they lose their vision while they are working with us, we take care of them from that time on out. We find some job to put them on where they won't hurt anybody, but when you are handling natural gas under high pressures you want the man to see where he is going so that he can take care of the rest of them. We do not have them all under one roof where we can say, "You do this and you do that." We may have a man twenty miles from any other fellow and he has a job to take care of and he must do it.

CHAIRMAN CAMERON: I will ask Mr. Kroger if he will make a contribution on this subject. What do you do with men who come in with defective eyes?

MR. KROGER: The gentleman has stated that we need physically fit men, but I should like to remind you that industry is doing things for a reason, and if they will take a one-eyed man on a certain job or they won't take a one-eyed man, surely something must have taken place in the past to justify such a rule or restriction.

You cannot expect the boss to open a bag and let you dip your hand in as regards every one-eyed man who comes to the gate and asks for a job. We exponents of safety realize that we have a rehabilitation program in our forge plants. Ten or fifteen years ago our eye losses were terrific. Coming to our employment office now and asking for a new job is like asking for three-quarters of the stock in our company. We do not have such a thing as a new employee. The labor legislation took care of that, but we do this: We do not expect our doctor in examining anyone's eyes to tell us where the man should work. We feel that we know what kind of eyes are required on a job. I think it is one of the greatest evils to expect any doctor to know all about what is going on in your shop and what kind of glasses are needed for each job. He is out of order when he attempts that.

If a man coming in happens to be a clerk, we have no restriction against his doing clerical work, or if he happens to be a draftsman. We feel that we are able to take care of such one-eyed men. Our experience in the shop is very much like the gentleman mentioned. Those who have lost an eye while employed by us we will take care of, but we will not take any others. But in my opinion, sooner or later we are going to have to take them, and I hope that we do not get into the national defense program to the extent that we have to take too many until our brethren, the manufacturers, really find something that will take care of the one-eyed man as well as the two-eyed man.

Depth Perception and Color Blindness

CHAIRMAN CAMERON: I have another question in this same field: "Defective eyesight has been named as one of the contributing causes of accidents. Give actual cases where lack of depth perception or color blindness or other defects caused accidents." I understand that Dr. Kuhn is in the audience, who has made quite a study of this subject and I am going to call on her.

DR. HEDWIG S. KUHN (Hammond, Ind.): In direct answer to the question as to whether depth perception has caused accidents, we have so many illustrations in our recent survey of 16,000 individuals and their defects in industry that I could quote them

indefinitely. There was the crane operator who said, after he had had his depth perception and muscle imbalance corrected after six months of training orthoptically, "The fellows under me can now work with safety. When I first came in I could not tell within 20 feet where I was dropping my load. Now I can put it on a dime."

An ingenious safety director in a large corporation who had a man with no depth perception wanted to prove to himself that there was a lizzard. So he took away all of the stationary machinery that he could possibly move away, destroying the landmarks with which this man had been working, and he said to him: "Go about your business." But he couldn't drop his load within 15 feet of where he was supposed to after the removal of the permanent fixtures which had guided him in his job.

Now with a crane operator who works with permanent fixtures, that is one thing; with somebody who works with changing conditions, like tractor drivers and automobile drivers, etc., it is another thing; we have never dug out the accident records on depth perception alone. But our charts show how many more people with lost-time accidents did have depth perception defects.

I am going to interject here one or two statements that are, I hope, a contribution to this discussion.

Our obligation to protect the worker's eyesight we feel is greater than realized, and includes, as Dr. Davidson indicated, additional factors besides goggles and the study of accidents and data on acuity. His basis of 8 per cent of serious visual defects was on a compensation basis, whereas 20/20 is taken as normal. Our figure of 15 per cent of serious eye defects is on the basis of what we designate a practically normal vision from industry's standpoint and, therefore, includes also serious eye muscle imbalances which interfere directly from a safety standpoint with that person's job. I think that ophthalmologists can learn and cooperate with management on what an individual's eye should do, because when we are all done figuring it out with management, we have to help them correct them, don't we?

The concept is that visual performance, as Dr. Davidson indicated, is a varying function arising from varying demands of the job. We designate eyes for the job and

I have just two thoughts to contribute to this discussion. The first is that there is a direct correlation between visual performance and accuracy, and accuracy is the same thing as efficiency. The second is a reference to Mr. Cameron's statement of the shortage of skilled labor. I take this figure out of our project:

According to statistics, if the efficiency of the present employed force of skilled labor could be increased three to five per cent, it would cancel out the present lack of skilled labor or the likelihood of such a shortage occurring. Job training inside of industry, plus the proper type of physical examination which includes visual performance as an aptitude test, which means more than acuity, could accomplish this three to five per cent increase in efficiency, and it would do this without any of the personnel problems, dislocations and moving of jobs, strikes, grievance committees, etc. While machine power has been geared up to 90 per cent of its efficiency, human power or efficiency has as yet been geared only to 40 or 60 per cent of its efficiency.

MR. TINGLEY: I do not want you to misinterpret me about not taking people

into industry just because they have one eye. We take clerical workers and people like that with very poor vision if they are corrected with glasses, but it happens that our particular industry is very dangerous.

MR. KROGER: I meant no slam at doctors when I made mention as I did. I will say this to Dr. Kuhn or to any other ophthalmologist, optometrist, or any other man who attempts to make fittings commensurate with the classifications of work, give him to me for six months and let him walk daily with me through the plant and after he gets his mechanical knowledge and education as to what is required of the worker, I will bet my shirt he can fit glasses 100 per cent better than he did.

CHAIRMAN CAMERON: I think that you and Dr. Kuhn should get together, because I think that she also has had a great deal of practical experience. I understand that the National Society for the Prevention of Blindness is going to make available the paper covering the results of a long series of studies performed by Dr. Kuhn to members of the National Safety Council and of the National Society.

Thank you very much for your splendid cooperation this morning.

ADJOURNMENT