Droplets of mist are necessarily microscopic in size or they would not remain in suspension. As soon as several droplets collide and form a large drop the liquid settles out. Therefore, it is possible to dispel a true mist very readily by simply stirring up the air—ventilation or dilution is unnecessary.

Mist droplets can be filtered out by ordinary dust respirators—that is, the visible portion of a fog is easily removed by filtration—but the gaseous constituent may pass through the filter. If the mist happens to be corrosive to fabrics the resultant effect upon a dust respirator is bad. Paint spraying generates a mist and a certain amount of vapor. Protection usually consists of an air-line respirator but it is not at all uncommon to use cartridge respirators containing activated charcoal and a filter.

A gas contains no solid or liquid particles under ordinary atmospheric conditions. The filter units of any of the common makes of respirators are ineffective against gases. Respiratory protective equipment which catches gases always consists in some chemical agent which either absorbs the gas or converts it into some other substance which can be absorbed. Because one can rarely be sure of the gas concentration to be encountered it is common practice in exploring man holes, for instance, to use devices supplied with air or oxygen in order that the wearer may be safe, regardless of the conditions he finds. The gas mask, however, and its outgrowth, the chemical cartridge respirator have a definite place in industry and are in wide use today.

The U. S. Bureau of Mines has helped in the manufacture and use of respiratory protective equipment greatly by its issuance of specifications for permissible equipment. Their present schedules do not include the air-supplied respirators such as those used in paint spraying or sand blasting but both the Bureau and the American Standards Association will issue such specifications presently.

Discussion following the address was based on these points:

1. What protection is provided against a dangerous accumulation of air pressure in the ordinary fresh air hose mask?

The helmet is not rigid. Air will leak out long before a dangerous pressure accumulates, or a safety link, provided in some types of hose mask, will blow out.

2. Would a protective mask approved for lead dusts filter out zinc oxide?

Yes. However, almost any type of mask will filter out zinc oxide, since these particles are easily trapped.

3. Will the simple face mask filter out ordinary smoke or will it absorb it?

It is impossible to answer such a question. There are as many types of ordinary masks as there are ordinary dusts. A mask must be purchased to fit a specific need. This is not difficult, however, since all types are available.

Glass Used for the Protection of the Eyes Against Injurious Radiation

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The effect of excess visible light on the eye is immediately felt. If there is too much, anyone except the sun gazers immediately turns away, closes the eyes or seeks some kind of relief. There is a tendency to use too dark glasses in welding, inherited from the days when even the blackest glasses gave practically no protection from the insidious invisible radiations. A proper rule is, use a shade number which gives good, immediately comfortable vision and insist that this glass give protection against the invisible radiations.

The effects of the ultra-violet and the infra-red radiations are not as quickly noticed as the visible. We cannot say, as we said for the visible, "get good immediately comfortable vision" because the first noticed effect of the ultra-violet occurs several hours after the exposure and the infra-red effect is usually longer delayed.

One outstanding piece of research was that of Sir Wm. Crookes on glasses to protect the eyes of glass workers. From statistical data, Crookes arrived at the conclusion that the ultra-violet and/or the infra-red produced cataract in the human eye. This was important, but the real importance of his research was that he found that the infra-red was absorbed by iron in the ferrous state in ordinary glass.

Also, he found that a cerium compound when added to glass was an excellent absorber of the ultra-violet. These two discoveries were important in the manufacture of good absorbing glasses, although full advantage was not taken immediately because Crookes found no ultra-violet, but only infra-red, present in the radiations to which glass blowers were subjected during their working hours. These last four words should be underlined from the indications of modern research.

A very important paper was published by Von der Hoeve of Leyden in 1920 which showed the tendency of ultra-violet to produce either cataract or macular degeneration. Macular degeneration has not been considered as frequently as cataract in the literature. Probably it occurs more frequently after the removal of the crystalline lens in the cataract operation. The crystalline lens is in many cases, although not always, an effective screen cutting out ultra-violet.

Dr. Janet Clark has published an outstanding research paper which appears to tie together both ultra-violet and infra-red in its more serious forms of injury to the human eye, that is, cataract. She says: "The initial process of light denaturation may therefore occur in the lens without any visible opacity, and it is probable that there is always some denatured protein present as the result of exposure to sunlight." . . . "The second step in light coagulation by proteins is very much accelerated by heat and occurs rapidly at 40° C. (104° F.) . . . It is probable therefore that the higher incidence of cataract in workers exposed to molten glass and metals is due to an increased rate of precipitation of light denatured protein when the lens is heated above body temperature by exposure to large sources of radiant heat, and when low concentrations of calcium or other substances producing a similar effect are present."

We always have some ultra-violet in sunlight. In welding, especially arc welding, we have extremely intense ultra-violet. Add to this the infra-red from hot metal or "radiant heat" and combine this with a very slight excess of calcium and we have the necessary and sufficient conditions to produce cataract.*

We have considered the more serious results of radiations. The less serious, although extremely uncomfortable at times, are more often experienced. The most common is "sand in your eyes," from ultra-violet falling on the conjunctiva. This is not comfortable to say the least, and frequently is caused by reflections from the original source reaching the side of the eyeball. Some white paints do not reflect the ultra-violet while others do. One of the best reflectors is an oxidized aluminum surface, one of the poorest is a highly polished silver surface, quite different from the way these materials reflect visible radiation.

The first felt action of infra-red on the eyes varies among different individuals and with different regions of the infra-red. The long wave infra-red (longer than about 1.5) is absorbed by the water in the tears or the conjunctiva at the very surface of the eyeball, since water is extremely opaque to these radiations. Shorter wavelength radiations than this, but longer than the visible waves, penetrate deeper and deeper into the eye. The simplest way to avoid the different types of eye troubles so produced is to eliminate both types of infra-red radiations.

The early glasses used for protection were a delusion and a snare. The visible was reduced so much that the work could not be seen, in the hope that the eye would be protected. Sometimes the ultra-violet would be eliminated, sometimes not. The infra-red was usually well transmitted, about as well as with two or three layers of ordinary window glass.

The infra-red was another matter, rarely being reduced much by accident. Only two cases do I remember, one an

* Many other conditions may produce cataract besides excessive radiations.