With these fundamentals in mind various kinds of spring knee leggings were created—one of the first great improvements in legging construction. However, in some cases there seemed to be justified complaints about the circular springs getting too hot for comfort and so the manufacturers promptly eliminated this by covering the springs or insulating them. Spring knee leggings still are preferred by some and will undoubtedly be used for many years to come.

But we find many new so-called springless types of leggings appearing in the field. We also find that the old stunt of wrapping legs in wet burlap is almost extinct, thanks to the efforts of safety men.

Subsequently the springless type of legging further combined safety and comfort. The popular appeal of this type was chiefly its greater comfort and finer adjustability. Every conceivable kind of fastener is here used to insure ease of putting on and to assure quick removal. Entirely new fasteners have been developed and use has also been made of already existing types.

Individual features carry their appeal to safety men, but all recognized types of leggings on the market today are much more comfortable and safe than those of a few years back.

Leg protection against acid splashes calls for not nearly so many styles of leggings but is adequately covered. The types of leggings and spats that protect against cuts, bruises, and similar injuries are many and varied. Some are made from a heavy leather base covered with metal reinforcing strips, properly placed to give the needed protection. Others are made entirely of heavy fibre with or without metal flares as the hazard demands. Steel studded chrome leather is also used in some cases. There are styles made from chrome leather reinforced with flexible reeds backed up by felt to act as a shock absorber. A most interesting anti-rattlesnake legging is made in a sort of spring knee type, using fibre as a base and covering it with water-proofed duck as a further protection while walking through long wet grass.

Pure grain rubber mounted over light leather has been successfully used as leg and foot protection against sand blast shot. Hip length leggings, while used in lesser numbers, are still standard equipment in foundries where protection is needed from the hip down. They range in style from regular pant leg shapes to extensions put on spring knee or springless type leggings and are made from asbestos cloth, fireproofed duck, and leather. A combination of chrome leather bottom with an attachable asbestos top has proved a very desirable style from both a safety and an economical standpoint. Here again, as in the knee type, safety, comfort, adjustability, ease of putting on and taking off are important factors. Of course, almost any of these styles of leggings is adaptable for other uses, especially when sparks, molten metal or severe heat are encountered.

In rather rare instances light leggings or spats have been used with more or less success for leg and foot protection for women.

Proper protective apparel will speed up production, will keep men on the job, will keep them happy, and will increase profits.

The following questions were brought out in the discussion:

1. Do spats give as good leg protection as leggings?

No.

2. Why are spats worn at all?

They are used when workmen have an aversion to leggings or when only low splashes of hot material are expected. In the latter case, however, the workman wearing spats is taking a gamble, because, by the law of averages, the hot splashes may not always be low.

3. What material is the best heat resister?

Asbestos gives the best protection from severe heat, but this material will not stand wear and friction as well as some other materials.

Respiratory Protective Equipment for Use Against Dusts, Fumes and Gases

By PHILIP DRINKER
Boston, Mass.

There appears to be some confusion as to the distinction between dusts, fumes, vapors, mists, and gases, with the result that respiratory equipment for protection against them occasionally is wrongly applied. The respirator manufacturers have many examples of such misunderstandings and often are blamed for errors which result solely from confusion in nomenclature.

Dusts include all types of dry earthy particles small enough to be blown about by ordinary air currents. Dust suspensions may be generated as the result of a grinding, blasting, or comminuting process; or they may result from the handling of finely divided materials as in mixing processes, in sweeping, or the blowing about of wood flour, plant pollens, or common road dust. There is no chemical limitation implied by the term "dust" while the range in size of dust particles extends from the sub-microscopic to small sand grains. Such materials can be caught very effectively by the modern type of dust respirator.

Fumes embrace two definite kinds of atmospheric suspensions. It is unfortunate that such double-naming exists in the trade but one had best admit the fact. Thus, "lead fume" is a very old term used to describe the visible dark grey suspension which evolves from lead heated to high temperatures. The material in such suspensions is mostly tiny particles of lead (and lead oxide), much smaller in size than those of the average dust, with some lead in the gaseous state. When such a mixture is cooled down to the point where it can be breathed the contaminant is then the lead particles alone without any gaseous lead.

The word "fume" is also used to describe the mixture of gas and mist which may come from a bath of hot nitric acid, for example. None of the material in the suspension is dry—it is all in the form of a true mist (liquid droplets) or as a gas, yet it may have a thick brownish color. One buys fuming sulfuric acid (a liquid) from any chemical supply house and one can see large plants for recovering lead fume—a dry powder. Obviously, one does not want the same kind of respiratory equipment for two such different substances yet the customer often asks for a respirator to protect against fumes.

Lead fume happens to be very difficult to filter out so that the ordinary respirator which catches dust particles may be inadequate against lead fume. The acid fumes, containing both liquid particles and gas, require a filter to catch the droplets and a gas absorbant to catch the gaseous constituent. Therefore, it usually happens that the respirator manufacturer, in self protection, advises the customer to use an air-supplied or air-line respirator because he will then be adequately protected whether the fume is of solid particles, like lead, or a liquid and gas mixture. If the customer stated exactly what the suspension consisted of or told how it was generated he might be able to use less expensive equipment.

A vapor is a gas which can be converted into a liquid at ordinary temperatures and pressures. Thus, water vapor is a common constituent of the air and is contained in concentrations which vary with atmospheric conditions. Respiratory protective equipment is used against low concentrations of a great many vapors arising from common organic solvents such as benzol. Many such substances are absorbed by activated charcoal as in gas masks. There is a small cartridge type respirator in which the cartridge is filled with activated charcoal for absorbing a vapor such as benzol or with soda-lime for absorbing an acid gas such as carbon dioxide. Because these small cartridges contain comparatively little of the absorbant their use is limited to very low concentrations. They should not be used for emergency rescue work.

A mist consists of a suspension of liquid droplets together with the gas from which the droplets condensed. The commonest example is atmospheric fog.