BOOT LEATHER: WITH SPECIAL REFERENCE TO THE TROPICS.

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In the Journal of the Royal Army Medical Corps there have appeared from time to time articles on the design and construction of Service footgear, but little or nothing appears to have been said regarding the materials of which the Army boot is made. This short note is an attempt to repair the omission.

Boots and shoes worn for general utility purposes are nearly always made of leather which has been chrome tanned, or vegetable tanned.

Chrome tanned leather is almost universally used in the manufacture of all portions of civilian boots and shoes, the soles excepted. For the latter, leather prepared by the old process known as vegetable tanning continues to be employed.

In vegetable tanning the skin of the animal (or, to use the trade name, the "hide") is soaked, washed and placed in a solution of lime for a week. It then has the hair and fat removed by scraping, and is delimed in a weak acid, such as boric or lactic. After this it is passed through a succession of pits which contain the tanning liquor, a strong cold infusion of oak, babul, or other bark and myrabalan nuts. The liquor in these pits gradually increases in concentration or specific gravity, so that the hide begins with the weakest and finishes with the strongest. After about five months of such treatment the hide is tanned and becomes leather in the crust state. It is then reduced to a uniform thickness and thereafter curried. Currying is the process by which the moist leather has dubbin rubbed into it. The dubbin is a composition of tallow and fish oil. Next, the leather is polished on the grain side and finally allowed to mature.

In chrome tanning the methods adopted are quite different. The hide, after passing through the liming stage, is treated with chromic acid or chrome alum. It is then pickled in a bath of salt and hydrochloric acid, or aluminium sulphate and sulphuric acid. It may also be treated with sodium thiosulphate or certain other chemicals—depending on the class of leather required or the special formula employed in any particular tannery. After tanning the leather is treated with oil to give it the requisite softness and flexibility.

In some chrome tanneries a single bath is used; in others, a double bath method is employed; but variations such as these depend on the particular trade class of leather which it is desired to turn out.

The outstanding characteristics of chrome-tanned leather are a high...
tensile strength, flexibility, and imperviousness to water. The preparatory process may be counted in hours, that of vegetable tanning in the same number of weeks. Although in chrome tanning the necessary chemicals are comparatively expensive, the whole process is somewhat cheaper than vegetable tanning. Besides, as chrome leather does not need to be dubbined, its storage is easy. Chrome leather has not yet replaced vegetable-tanned leather for a number of important uses besides that of soleing boots. Vegetable-tanned leather is still found to be the more suitable for such purposes as machine belting, harness, saddlery, hydraulic washers, etc.

So much for manufacture; what is the position as regards wear?

In a temperate climate boots with chrome leather uppers can be worn without undue discomfort; but, in a tropical climate, these boots are far from comfortable. To use an expressive phrase, they "draw the feet." In other words, in the inside of the chrome leather boot there is a comparatively high degree of humidity.

Analysis of chrome leather shows that there are no free chemicals in quantity sufficient to cause harm to the skin of the foot; and when shoes made from chrome leather are worn, the "drawing" effect complained of when boots are worn is not noticed.

From this it might be thought that the high humidity is due merely to defective ventilation in the interior of the boot. Naturally, in the case of shoes, ventilation must be more efficient. However, it is found that boots made of vegetable tanned leather are cooler to the feet than those made of chrome leather, and that this comparative coolness is not due to any superior ventilating qualities possessed by the former type. Practically speaking, vegetable tanned and chrome leathers are to all intents and purposes air-proof. Hence, it is not a question of simple ventilation.

Experiments show that, as compared with vegetable-tanned leather, chrome leather has a high initial absorption rate for water and watery vapour, but that, in a short time, this rate rapidly diminishes, and eventually becomes very slow. The absorption rate of vegetable-tanned leather is not only good, but nearly constant.

The practical results of these differing qualities are that, in the case of chrome leather, after a certain time has elapsed perspiration remains penned up in the boot; while, in the case of vegetable-tanned leather, after the same period and under the same conditions perspiration continues to pass through the leather to the outer air, where it is dried off by evaporation. Evaporation results in cooling, and this cooling effect is transmitted to the wearer's feet. By contrast, the water-logged chrome leather produces a vicious circle by raising the interior temperature, increasing perspiration and causing the socks and the skin to become permanently sodden.

Perhaps it is not strictly, and certainly not scientifically, correct to say that there is no ventilation in the interior of a boot. In walking, the movements of the feet in the boots must displace, outwards and inwards, a greater or lesser quantity of air at every step taken. Even with rubber
boots a certain amount of this kind of ventilation takes place. But in the case of rubber resistance to the penetration of moisture in any form is absolute; there is no evaporation from the outer surface, hence no cooling effect, and internally there is a permanent state of humidity over saturation point.

It might be possible, by the provision of air ducts leading from the top edge of the uppers to below the instep, greatly to improve ventilation; but it is doubtful if ever a sufficient quantity of air could be provided to render ventilation anywhere near perfection. Still, that is a constructional problem which might be worth trying out, at least in the case of chrome leather boots.

In India, the Army boot is made of vegetable-tanned leather. At home, chrome leather boots are accepted from the manufacturers up to 50 percent of the contract. Both at home and abroad troops prefer the chrome leather variety because the boots, not having been treated with dubbin, look neater, cleaner and take a polish more easily. In India, the dislike of the dubbined boot is accentuated on account of the fact that the flesh side of the leather is on the outside. So, in deference to the spick and span spirit, the leather is often deprived of its grease by means of injurious chemicals, and a wax polish is applied which fills the grains, acts as a waterproof varnish, hinders the passage of moisture, and thus destroys the cooling effect of evaporation. Thus is efficiency sacrificed for the sake of appearance. However, it should be added that this undesirable practice is less common now than it used to be.

From the above we may conclude that, for tropical climates, the most satisfactory boots are those made from vegetable-tanned leather which has been treated with dubbin, and which has not been ruined because of a desire to secure a polished surface; that chrome leather boots are not suitable; and that rubber boots are definitely and markedly unhygienic.