Shrink-Resistant Woolen Garments

A major cause of waste in textiles is unsatisfactory performance due to shrinkage. In recent years the invention of mechanical equipment to control shrinkage of lightweight cottons has led to very great improvement in this field. However, reduction of shrinkage in all types of wool fabrics remains a serious textile problem.

At the present time, under the Quartermaster research program, major study of this problem is directed toward the development of a suitable shrinkage-inhibiting treatment for woolen and worsted fabrics and garments. Of all the various woven and knitted clothing items laundered by the Army, those made of wool present the greatest difficulty because of the peculiar felting tendencies of the basic fibrous material. Army sweaters, for example, have shown as much as 40 per cent shrinkage (back length), jungle shirts, 45 per cent, and flannel shirts, 16 per cent—all after one very severe laundering. Army blankets were also reduced in area as much as 25 per cent after one severe laundering. Many methods are being used to minimize this felting shrinkage, such as modification of the fabric construction and alteration of the laundering process. Considerable promise has been shown by treatments which coat the surface of the wool fibers, modifying their frictional characteristics and thereby reducing this felting tendency.

Two major classes of treatment are being studied at the present time—chlorination and resin. A wet chlorination process was developed and used with considerable success by the Army, during the war, for producing shrink-resistance in the cushion-sole sock. This treatment, known as the "controlled chlorination process," effectively restricts the felting tendencies of the wool without appreciably damaging or modifying its desirable mechanical properties. Now, another chlorination treatment has been developed which is superior to the controlled chlorination process in that it may be applied to 100 per cent wool piece goods, or top, by a padding procedure whereby the surface characteristics of the fiber are changed but its cortical regions are not penetrated by the compound. This result is obtained by rapidly passing the wool through a solution with a relatively high chlorine concentration, permitting only very brief contact between the chlorine and the fabric. Laboratory and field tests have shown that this treatment will effectively reduce the felting shrinkage of Army shirting material to less than two per cent in the warp or filling direction after twenty launderings, without changing the shade or damaging the fibers in any way. A comparison of a shirt treated by the new chlorination process with a corresponding untreated shirt after thirty launderings is shown in Figure 1.

Of the many treatments developed commercially for piece goods, the resin processes show considerable promise. Accordingly, emphasis has been placed on the evaluation of these treatments from the standpoint of shrinkage-control as well as from that of the effect on other military requirements for fabrics. Results of these exploratory investigations have shown commercial resin treatments to be effective in controlling shrinkage in Army shirting without mate-

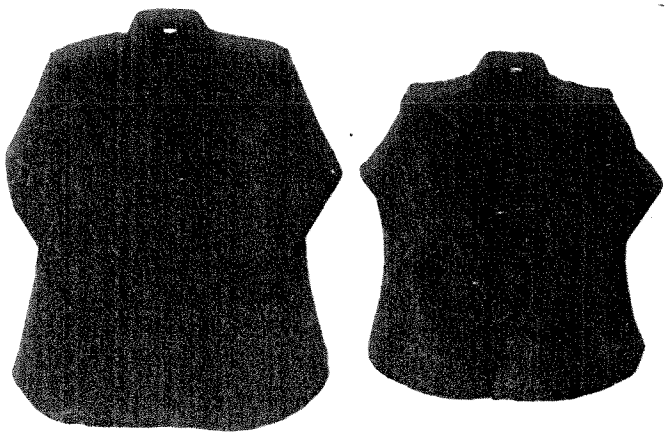

Fig. 1.—Shirt at left, treated with new chlorination process, and shirt at right, untreated, show relative effect of thirty launderings.

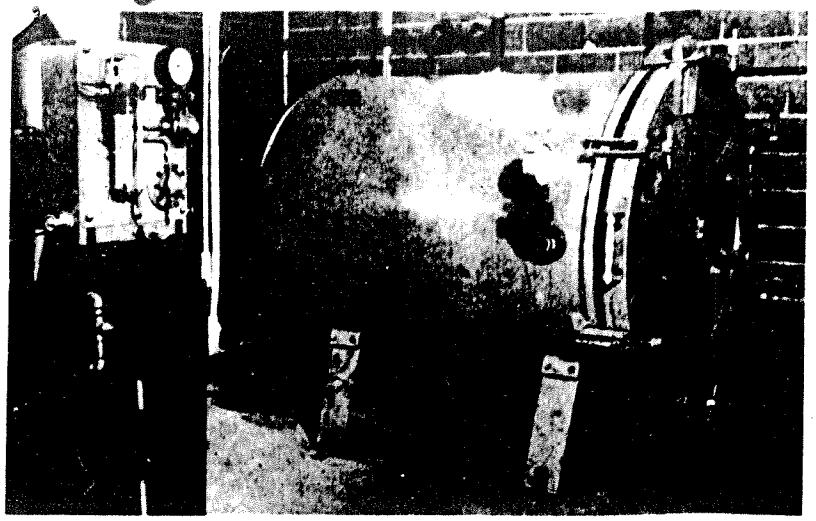

Fig. 2.—Dry chlorination unit.

rially impairing the wearing characteristics of the shirts. After twenty-five wool mobile launderings, the shrinkage in back lengths of shirts treated by three different resin processes was as follows:

Resin I	3.2%	Resin III	4.6%
Resin II	3.7%	Untreated	15.9%

As a result of the experience obtained, to date, with chlorination and resin treatments, the Quartermaster Corps Research & Development Laboratories have issued proposed specifications to serve as a guide in future procurements of shrink-resistant treated fabrics.

Work is also in progress to develop a method of treating garments now in Army warehouses. Considerable success has been obtained by using a dry chlorination process, which was developed originally in England but has been adapted in this country by the Quartermaster Corps for treating finished garments. The dry chlorination unit (*Figure 2*) consists essentially of a large autoclave in which the garments are subjected to treatment by chlorine gas under controlled conditions of temperature and pressure. After chlorination, the garments are further chemically processed to neutralize the excess chlorine and thus prevent deterioration of the sewing thread and wool. Flat-knit sweaters treated by this process were found to shrink only 12 per cent in the body length dimension after a very severe laundering, while an identical untreated control shrank 40 per cent. Another promising method of treating finished garments is use of a resin emulsion, which may be applied by an exhaustion procedure similar to that used in dyeing. The resin emulsion is placed, with the garments, in a suitable bath, and is salted out by means of sodium sulfate until the bath is exhausted. Sweaters so treated were found to be wearable after twenty field launderings, while the average Army sweater is unwearable after four such launderings and may have to be discarded after one. Shown in the table are the body-length shrinkages noted after one, four, eight, twelve, and twenty launderings of these items.

	NUMBER OF LAUNDERINGS				
	1	4	8	12	20
Treated	1.2	2.0	2.4	2.4	2.4
Untreated	9.9	17.2	24.9	32.2	37.4

The resin emulsion process and the newly developed chlorination process have been found to be effective in controlling shrinkage in woolen blankets. The loss incurred because of the felting shrinkage of these items has been considerable, especially in the Medical Corps, where frequent laundering and sterilization is necessary.

The great amount of research work carried out by the Quartermaster Research & Development Laboratories and by industrial laboratories in developing shrink-resistant treatments assures the increasing availability of wool clothing which will withstand frequent field launderings without losing its utility through shrinkage.

LOUIS I. WEINER
QM Research & Development Laboratories

Hot Spot on the North American Continent

The hottest place on the North American continent is the surface of the ground in Death Valley during the month of July. On the basis of averages covering thirty-six years, a maximum temperature of 180° Fahrenheit may be expected on the desert floor on one day every seven years. At five feet above the ground—the level where official temperatures are recorded—the reading would be 125°.

A study of temperature data for Death Valley, prepared for presentation to the American Meteorological Society by Arnold Court, meteorologist in the Office of The Quartermaster General, shows that the highest temperature ever reported for Death Valley at five feet above the ground was on July 10, 1913, when 134° was registered. During the week of July 7-14, 1913, the maximum for each day did not fall below 127°—a record which has not been equalled since.

While the surface of the desert sand or gravel attains the highest temperature, the air in immediate contact with it is almost as hot. In general the decrease of air temperature upward from the surface is logarithmic. Thus, with a surface temperature of 160°, the temperature at one-foot elevation would be 142°; at 5 feet, 116°; at 500 feet, 100°; and at 2,000 feet, 92°.

The studies are part of the Quartermaster Corps research program which is seeking data on climatic conditions throughout the world as a basis for supplying the Army with clothing which will provide protection against any environment. Army maneuvers are frequently held in the desert area adjacent to Death Valley.