The Identification of Fibers

The Hair Fibers

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(*Continued from September issue p* 468)

Among the fibers produced by the skins of animals by far the most important is that from the sheep, universally known as wool. While fibers from several animals are sometimes referred to as wool this word, when unmodified, should be used only to refer to the fiber produced by the sheep. When this word is used to refer to the fiber produced from the skin of some other animal the name of that animal or some other descriptive word should be used, as "alpaca wool."

Wool

Wool is always thought of as a fiber which is fine, soft, and curly. Fine sheep wool possesses these characteristics to a high degree, but coarser grades contain coarse, stiff fibers, which are properly called hairs. In this connection it may be noted that various animals produce fibers of two distinct kinds—a fine, soft, wool-like fiber and a coarser, stiffer fiber.

Presumably due to the many years of careful breeding, sheep of the breeds mainly grown for their wool show a much narrower range of fineness of fiber than do most other animals. The writer has shown (4) that in wools of fairly good quality the variation in diameter of fibers in a single lock is usually only about two-thirds of the average diameter. Thus if the average diameter of fibers in a lock is 14 microns, the variation in diameter will probably be 9 or 10 microns, with finest fibers probably about 9 and coarsest about 19 microns in diameter. In a sample of fabric or yarn, experience indicates that a wider variation, probably about 100% of the average diameter, may be expected. If the sample is blended from several grades of wool larger variations will be met. With most hair fibers a considerably larger variation is observed. Thus in samples recently examined the following variations in diameter were noted:

	Fiber Diameter	
	Maximum	*Minimum.*
Camel Hair	72 microns	19 microns
Cashmere	38	13
Llama	53	20

While these variations are much greater than are normally met in wool of good quality the writer has observed variations from about 20 to 70 microns in a sample of carpet wool having an average diameter around 34 microns. This wool, from western Asia, where sheep are not carefully bred for high quality wool, serves to indicate to what degree the comparative uniformity of high grade wool is due to the efforts of the sheep breeders.

Fineness of Wool

Among the various characteristics of wool, the one for the study of which the microscope is particularly adapted, is fineness. This property is usually judged by the unaided eye, and by practice the eye becomes very efficient in the work. However, when a conflict of interests arises the eyes of opposed experts are liable to see things in a light favorable to their own interests. For this and other reasons it appears well to have some method for judging fineness of wool more accurately and with less influence from the personal equation than can be done by the unaided eye. Those wishing to give further attention to this matter are referred to writings by Hill (5), by Holden (6) and the writer (7), (8). For the present purpose it is only necessary to consider various types of wool in a general way.

In Figure 10 we see an example of fine wool. It is from a 74's top from a well known top maker. The uniformity of diameter as well as fineness is worthy of note.

A wool of medium fineness is shown in Figure 11. This wool is from a 58's top.

In Figure 12 is shown a coarse wool, classed as "britch" by a well known topmaker. In such coarse wools the scales are larger, and often less distinct than in finer wools. Often coarse wools contain "kemps." In undyed, white wool these appear as coarse fibers with little luster. Presumably the lack of luster is related to the presence of an opaque center (medulla) in the fiber. This also increases the appearance of coarseness when the fiber is viewed by the unaided eye. Thus a kemp will appear coarser than a normal fiber which is really slightly larger than it is. As seen in Figure 12, in making which transmitted light was used, the opaque center appears black. If viewed by reflected light it would appear white if in white wool. The cause of this opacity is said to be the presence of air bubbles. In some fibers it appears probable that the medulla contains granular matter with air filling the interstices between granules. No doubt other causes may also produce an opaque fiber. When dyed, kemps do not ordinarily take the dye well. This effect is well

illustrated by Figure 12. The white wool to be photographed was first stained in a dilute solution of basic fuchsin. The kemp fiber was colored scarcely more than the fine fibers while the coarse fiber which was not a kemp became nearly opaque, and so appears as almost black in the picture.

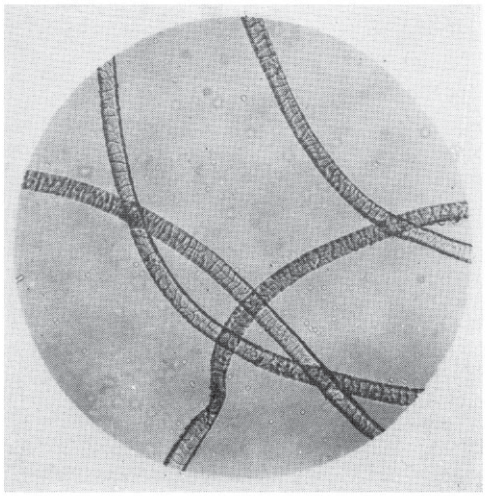

Fig. 10. Fine Wool (74's) Magnif. 125 X

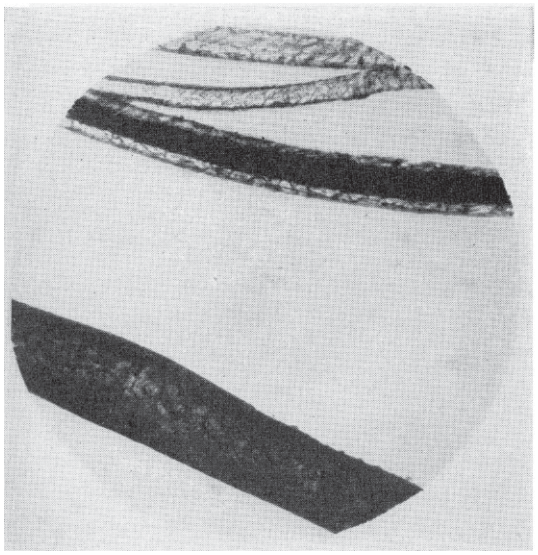

Fig. 12. Coarse Wool (Britch) Magnif. 125 X

One sometimes wishes to know whether a sample consists entirely of wool that has never before been used (so-called "virgin" wool) or contains some wool which has been re-manufactured (shoddy etc.). One may even be asked to determine the per cent of reworked wool in a sample. All competent people with whom the writer has discussed this subject agree that it is not practicable to make this determination. The best that even a skilled microscopist should attempt to do is to form an opinion as to whether there is much, little, or no re-worked wool present. Some of the characteristics of reworked wool are illustrated in Figure 13. The broken or bruised fibers and split ends are good indications of re-worked wool. The presence of occasional foreign fibers, of fibers much coarser or finer, or of a different color from those forming the bulk of the material, is also to be looked upon as indicating the presence of reworked wool.

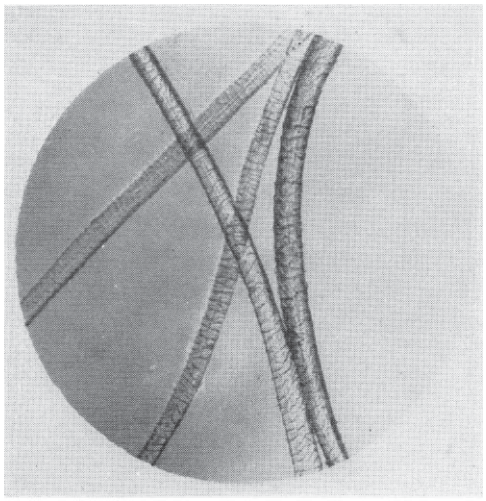

Fig. 11. Medium Wool (58's) Magnif. 125 X

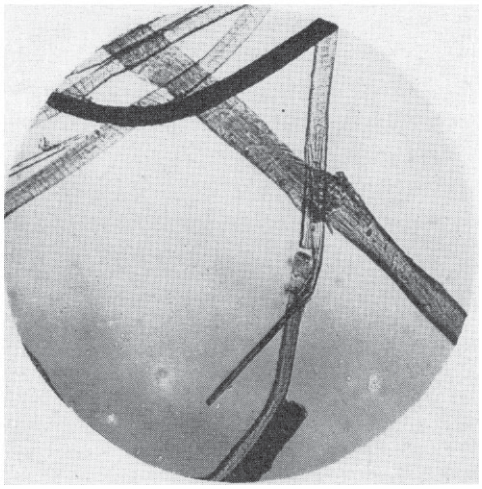

Fig. 13. Re-worked Wool (Shoddy) Magnif. 125 X

None of these indications should be taken as proof however. Even broken fibers may be caused by normal manufacturing processes, especially if the fabric has a nap. Experience and judgment of the microscopist are more important in this determination than in most others.

References

(4). H. B. Gordon, *Textile World,* March 10, 1923.

(5). J. A. Hill, Supplement of the Annual Report of the United States Experiment Station of Wyoming, 1910-1911.

(6). H. S. Holden, *Journal of the Textile Institute,* August 1922, pages 157-160.

(7). H. B. Gordon, *Textile World,* June 7, 1924.

(8). H. B. Gordon, *Textile World,* March 9, 1929.

(*To be continued*)