

THE TENSILE STRENGTH OF WOOL

by

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It is my purpose in this experiment to attempt to demonstrate the tensile strength of single wool fibers from four of the chief breeds, viz. Cotswold, Shropshire, Southdown, and the Rambouillet. Samples from different parts of the body were also compared. The apparatus used consisted of two jolly balances, a compound microscope with ocular or eye piece, micrometer, small forceps, mechanical stage, and other microscopic equipment. Two jolly balances were used because of the wide variation between the Cotswold and Rambouillet wools, the Cotswold fibers being so strong that a special balance with an extra strong spring or coil was required. The test was begun by first determining the constant of each balance, which was done by making the zero reading and then noting the displacement caused by a weight of one gram. Next, a wool fiber was fastened on the hook of the balance by knotting once and half-hitching. The tensile strength was then easily read in grams by simply pulling down on the fiber until it broke, the reading being made just at the moment the fiber parted. No particular length of fiber was used as the weight of a single fiber is so very slight that it was concluded the results would not be influenced. The only opportunity for a variation might be based on the theory that in a greater length the chances for weak points are greater. No objection can be raised on account of this theory, however, because a thread is no stronger than its weakest point. This last statement might also be cited as a reason for testing many fibers and each but once.

In connection with obtaining the strength of each fiber the diameter was also taken as it was found that the strength varied directly with the diameter. For the purpose of measuring the diameters, the fibers were fastened on a glass slide by means of balsam and cover slips. In this condition the fibers were held firm and

straight, so that with the aid of a micrometer - microscope and mechanical stage the diameter was very easily determined. Ten tests were made from each sample. The following is the data:

| No. of Sample | Breed    | Sample obtained from | Strength grams. | Diameter in m. m. |
|---------------|----------|----------------------|-----------------|-------------------|
| 1             | Cotswold | Right Shoulder       | 33              | .139              |
|               |          |                      | 28              | .1179             |
|               |          |                      | 22              | .103              |
|               |          |                      | 38              | .1408             |
|               |          |                      | 24              | .1075             |
|               |          |                      | 24              | .1129             |
|               |          |                      | 25              | .1139             |
|               |          |                      | 25              | .116              |
|               |          |                      | 31              | .118              |
|               |          |                      | 28              | .117              |
|               |          |                      | 278             | 1.1862            |
|               |          |                      | Mean 27.8       | Mean .11862       |
| 2             | Cotswold | Fleece               | 49              | .104              |
|               |          |                      | 25              | .0698             |
|               |          |                      | 25              | .079              |
|               |          |                      | 46              | .097              |
|               |          |                      | 26              | .0806             |
|               |          |                      | 24              | .069              |
|               |          |                      | 35              | .0949             |
|               |          |                      | 26              | .086              |
|               |          |                      | 32              | .0906             |
|               |          |                      | 32              | .0938             |
|               |          |                      | 320             | .8648             |
|               |          |                      | Mean 32         | Mean .08648       |

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1609

| No. of Sample | Breed    | Sample obtained from | Strength gms. | Diameter m. m.  |
|---------------|----------|----------------------|---------------|-----------------|
| 3             | Cotswold | Belly                | 36.5          | .126            |
|               |          |                      | 40.5          | .190            |
|               |          |                      | 36.2          | .1236           |
|               |          |                      | 31.0          | .1107           |
|               |          |                      | 38.5          | .1827           |
|               |          |                      | 27.3          | .1059           |
|               |          |                      | 32.6          | .1129           |
|               |          |                      | 26.0          | .0965           |
|               |          |                      | 34.0          | .116            |
|               |          |                      | 35.5          | .118            |
|               |          |                      | <u>338.1</u>  | 1. <u>.2823</u> |
|               |          |                      | Mean 33.81    | Mean .12823     |
| 5             | Cotswold | Left Shoulder        | 24.5          | .0696           |
|               |          |                      | 33.0          | .0980           |
|               |          |                      | 30.0          | .0929           |
|               |          |                      | 31.5          | .0930           |
|               |          |                      | 35.2          | .100            |
|               |          |                      | 29.6          | .0806           |
|               |          |                      | 30.0          | .0925           |
|               |          |                      | 41.0          | .1006           |
|               |          |                      | 44.0          | .1139           |
|               |          |                      | 26.0          | .068            |
|               |          |                      | <u>324.8</u>  | <u>.9091</u>    |

| Sample No. | Breed    | Sample obtained from | Strength gms. | Diameter m. m. |
|------------|----------|----------------------|---------------|----------------|
| 4          | Cotswold | Under neck           | 25.0          | .083           |
|            |          |                      | 28.0          | .0828          |
|            |          |                      | 24.0          | .0795          |
|            |          |                      | 30.7          | .086           |
|            |          |                      | 24.0          | .076           |
|            |          |                      | 22.0          | .0698          |
|            |          |                      | 25.0          | .0806          |
|            |          |                      | 21.0          | .069           |
|            |          |                      | 22.0          | .0736          |
|            |          |                      | 32.0          | .091           |
|            |          |                      | 253.7         | .7913          |
|            |          |                      | Mean 25.37    | Mean .07913    |
| 6          | Cotswold | Back                 | 23.0          | .0806          |
|            |          |                      | 25.2          | .1048          |
|            |          |                      | 22.0          | .075           |
|            |          |                      | 24.8          | .106           |
|            |          |                      | 23.6          | .087           |
|            |          |                      | 24.2          | .091           |
|            |          |                      | 23.5          | .086           |
|            |          |                      | 22.0          | .075           |
|            |          |                      | 23.4          | .075           |
|            |          |                      | 29.2          | .0795          |
|            |          |                      | 240.9         | .107           |
|            |          |                      |               | .8919          |
|            |          |                      | Mean 24.09    | Mean .08919    |

\$5.

1611

| No. of Sample | Breed       | Sample obtained from | Strength gms. | Diameter m.m. |
|---------------|-------------|----------------------|---------------|---------------|
| 7             | Cotswold    | Side                 | 22.           | .0806         |
|               |             |                      | 22.           | .0838         |
|               |             |                      | 22.2          | .091          |
|               |             |                      | 25.5          | .1048         |
|               |             |                      | 20.0          | .068          |
|               |             |                      | 28.3          | .107          |
|               |             |                      | 22.2          | .0976         |
|               |             |                      | 21.6          | .1129         |
|               |             |                      | 40.2          | .1155         |
|               |             |                      | 259.0         | .9362         |
|               |             |                      | Mean 25.9     | Mean .09362   |
| 8             | Cotswold    | Thigh (Outside)      | 24.5          | .0965         |
|               |             |                      | 22.8          | .0901         |
|               |             |                      | 19.0          | .075          |
|               |             |                      | 23.0          | .093          |
|               |             |                      | 21.0          | .086          |
|               |             |                      | 27.7          | .100          |
|               |             |                      | 31.0          | .1279         |
|               |             |                      | 29.0          | .1138         |
|               |             |                      | 26.0          | .0965         |
|               |             |                      | 22.0          | .086          |
|               |             |                      | 246.0         | .9648         |
| Mean 24.6     | Mean .09648 |                      |               |               |

#6.

/6/2

| No. of Sample | Breed    | Sample obtained from | Strength<br>gms. | Diameter<br>m. m. |
|---------------|----------|----------------------|------------------|-------------------|
| 9             | Cotswold | Back                 | 44.5             | .115              |
|               |          |                      | 39.2             | .1037             |
|               |          |                      | 23.0             | .087              |
|               |          |                      | 40.0             | .194              |
|               |          |                      | 30.3             | .091              |
|               |          |                      | 24.6             | .0806             |
|               |          |                      | 28.0             | .0899             |
|               |          |                      | 27.7             | .0960             |
|               |          |                      | 33.0             | .0927             |
|               |          |                      | 38.0             | .101              |
|               |          |                      | <u>338.3</u>     | <u>1.0509</u>     |
|               |          |                      | Mean 33.83       | Mean .10509       |
| 10            | Cotswold | Left Side            | 22.0             | .079              |
|               |          |                      | 21.7             | .0806             |
|               |          |                      | 32.0             | .0965             |
|               |          |                      | 28.2             | .0917             |
|               |          |                      | 30.3             | .0953             |
|               |          |                      | 32.6             | .0965             |
|               |          |                      | 25.0             | .0865             |
|               |          |                      | 26.0             | .087              |
|               |          |                      | 23.8             | .083              |
|               |          |                      | 23.0             | .0818             |
|               |          |                      | <u>264.6</u>     | <u>.8779</u>      |
|               |          |                      | Mean 26.46       | Mean .08779       |

#7.

/613

| No. of Sample | Breed    | Sample obtained<br>from | Strength<br>gms. | Diameter<br>m.m. |
|---------------|----------|-------------------------|------------------|------------------|
| 11            | Cotswold | Left Hip                | 40.2             | .0849            |
|               |          |                         | 40.0             | .0818            |
|               |          |                         | 40.11            | .0865            |
|               |          |                         | 26.4             | .0696            |
|               |          |                         | 35.0             | .0768            |
|               |          |                         | 49.8             | .1048            |
|               |          |                         | 36.4             | .075             |
|               |          |                         | 39.0             | .0725            |
|               |          |                         | 41.6             | .100             |
|               |          |                         | <u>58.0</u>      | <u>.0768</u>     |
|               |          |                         | 386.5            | .8287            |
| Mean 38.65    |          |                         | Mean .0827       |                  |

## Summary of the Means of all Cotswold tests.

| No. of Sample | Breed    | Sample obtained from | Strength<br>gms. | Diameter<br>m.m. |
|---------------|----------|----------------------|------------------|------------------|
| 1             | Cotswold | Shoulder             | 27.8             | .11862           |
| 2             | "        | Sheered Fleece       | 32.0             | .08648           |
| 3             | "        | Belly                | 33.81            | .12823           |
| 4             | "        | Neck                 | 25.37            | .07913           |
| 5             | "        | Shoulder (1)         | 32.48            | .09091           |
| 6             | "        | Back                 | 24.09            | .08919           |
| 7             | "        | Side                 | 25.90            | .09362           |
| 8             | "        | Thigh(outside)       | 24.60            | .09648           |
| 9             | "        | Back                 | 33.83            | .10509           |
| 10            | "        | Side (1)             | 26.46            | .08779           |
| 11            | "        | Hip                  | 28.65            | .08270           |
|               |          |                      | 324.99           | 1.05824          |
|               |          | Means                | 29.543           | .09620           |

The results are fairly gratifying, giving a grand average of 29.543 grams as the tensile strength per fiber for the Cotswold breed. The final average for the diameter was .0962 millimeters. The sixth fiber in the eleventh sample tested the highest tensile strength the result being 49.8 grams. The next highest figure was obtained from the first fiber in the second sample. This fiber tested 49 grams. Strange to say neither of these fibers gave the greatest diameter, but their diameters were practically the same, there being but .0008 of a millimeter's difference. The weakest Cotswold fiber tested 19 grams. Two others tested 21 and several 22 grams. The maximum and minimum diameters were .19 and .068 millimeters respectively. It might also be interesting to note that the wool measuring the highest average diameter was the sample from the belly. The smallest diameter in this sample was .0955 m.m. and two were above

.18 m.m. No remarkable strength was shown, yet it was above the final average. The wool making the greatest strength was obtained from the hip, and that from the back, (sample 9) and belly are about tied for second place. Two samples were used from the back but from different sheep. Of these two samples, one made the poorest test, and the other second best.

| No. of Sample | Breed       | Sample obtained from | Strength gms. | Diameter m.m. |
|---------------|-------------|----------------------|---------------|---------------|
| 12            | Rambouillet | Sheared Fleece       | 3.0           | .035          |
|               |             |                      | 3.2           | .043          |
|               |             |                      | 5.1           | .0397         |
|               |             |                      | 3.4           | .0446         |
|               |             |                      | 3.4           | .0376         |
|               |             |                      | 3.2           | .0268         |
|               |             |                      | 2.7           | .032          |
|               |             |                      | 3.0           | .0268         |
|               |             |                      | 2.6           | .027.         |
|               |             |                      | 2.8           | .0446         |
|               |             |                      | <u>32.4</u>   | <u>.3571</u>  |

Means 3.24 Means .03571

#10.

1616

| No. of Sample | Breed       | Sample obtained from | Strength gms. | Diameter m.m. |
|---------------|-------------|----------------------|---------------|---------------|
| 13            | Rambouillet | Back                 | 3.4           | .0397         |
|               |             |                      | 2.4           | .030          |
|               |             |                      | 2.6           | .032          |
|               |             |                      | 2.3           | .0268         |
|               |             |                      | 2.5           | .031          |
|               |             |                      | 2.8           | .033          |
|               |             |                      | 3.2           | .0365         |
|               |             |                      | 2.6           | .0279         |
|               |             |                      | 3.5           | .0397         |
|               |             |                      | 2.6           | .0327         |
|               |             |                      | <u>27.9</u>   | <u>.3293</u>  |
|               |             |                      | Means 2.79    | Means .03293  |
| 14            | Rambouillet | Sheared Fleece       | 3.3           | .0376         |
|               |             |                      | 4/2           | .0435         |
|               |             |                      | 3.9           | .041          |
|               |             |                      | 4.5           | .0473         |
|               |             |                      | 2.6           | .032          |
|               |             |                      | 2.6           | .031          |
|               |             |                      | 2.2           | .0268         |
|               |             |                      | 2.4           | .031          |
|               |             |                      | 4.0           | .043          |
|               |             |                      | 3.2           | .033          |
|               |             |                      | <u>32.9</u>   | <u>.3667</u>  |
|               |             |                      | Means 3.29    | Means .03667  |

#11.

1617

| No. of Sample | Breed       | Sample obtained from | Strength gms. | Diameter m.m. |
|---------------|-------------|----------------------|---------------|---------------|
| 15            | Rambouillet | Hip                  | 2.4           | .0258         |
|               |             |                      | 2.5           | .0306         |
|               |             |                      | 3.4           | .0376         |
|               |             |                      | 3.6           | .0319         |
|               |             |                      | 2.4           | .0268         |
|               |             |                      | 4.0           | .043          |
|               |             |                      | 2.3           | .0215         |
|               |             |                      | 2.45          | .029          |
|               |             |                      | 2.53          | .0315         |
|               |             |                      | 2.56          | .032          |
|               |             |                      | 28.14         | .03097        |
|               |             |                      | Means 2.814   | Means .03097  |
| 16            | Rambouillet | Thigh                | 2.6           | .0279         |
|               |             |                      | 2.9           | .032          |
|               |             |                      | 3.0           | .032          |
|               |             |                      | 3.1           | .033          |
|               |             |                      | 3.4           | .0349         |
|               |             |                      | 3.4           | .0349         |
|               |             |                      | 4.2           | .0376         |
|               |             |                      | 4.6           | .0376         |
|               |             |                      | 4.0           | .036          |
|               |             |                      | 5.1           | .044          |
|               |             |                      | 36.3          | .03499        |
|               |             |                      | Means 3.63    | Means .03499  |

#12.

1618

| No. of Sample | Breed       | Sample obtained from | Strength gms. | Diameter m.m. |
|---------------|-------------|----------------------|---------------|---------------|
| 17            | Rambouillet | Sheared Fleece       | 2.75          | .0306         |
|               |             |                      | 3.9           | .036          |
|               |             |                      | 4.2           | .036          |
|               |             |                      | 4.2           | .0376         |
|               |             |                      | 4.25          | .0446         |
|               |             |                      | 3.2           | .0349         |
|               |             |                      | 3.8           | .0349         |
|               |             |                      | 5.1           | .0537         |
|               |             |                      | 2.5           | .0268         |
|               |             |                      | 3.0           | .031          |
|               |             |                      | 36.9          | .3661         |
|               |             |                      | Mean 3.69     | Mean .03661   |
| 18            | Rambouillet | Belly                | 3.7           | .0387         |
|               |             |                      | 3.5           | .0376         |
|               |             |                      | 2.3           | .032          |
|               |             |                      | 2.0           | .0285         |
|               |             |                      | 2.9           | .037          |
|               |             |                      | 2.3           | .032          |
|               |             |                      | 2.4           | .0327         |
|               |             |                      | 2.9           | .0365         |
|               |             |                      | 2.5           | .0327         |
|               |             |                      | 2.6           | .0338         |
|               |             |                      | 27.1          | .3415         |
|               |             |                      | Mean 2.71     | Mean .03415   |

#13.

1619

| No. of Sample | Breed        | Sample obtained from | Strength gms.        | Diameter m.m.        |
|---------------|--------------|----------------------|----------------------|----------------------|
| 19            | Rambouillet  | Side                 | 2.4                  | .0338                |
|               |              |                      | 2.3                  | .032                 |
|               |              |                      | 4.0                  | .038                 |
|               |              |                      | 4.0                  | .0387                |
|               |              |                      | 4.2                  | .043                 |
|               |              |                      | 3.9                  | .0376                |
|               |              |                      | 4.3                  | .0537                |
|               |              |                      | 3.88                 | .0365                |
|               |              |                      | 2.4                  | .031                 |
|               |              |                      | <u>3.7</u><br>35.0   | <u>.036</u><br>.3803 |
|               |              |                      | Mean 3.5             | Mean .03803          |
| 20            | Rambouillett | Side                 | 3.12                 | .036                 |
|               |              |                      | 3.75                 | .0319                |
|               |              |                      | 3.46                 | .0387                |
|               |              |                      | 3.96                 | .0478                |
|               |              |                      | 2.75                 | .0268                |
|               |              |                      | 2.81                 | .032                 |
|               |              |                      | 3.9                  | .043                 |
|               |              |                      | 3.22                 | .0365                |
|               |              |                      | 3.71                 | .0387                |
|               |              |                      | <u>2.96</u><br>32.64 | <u>.032</u><br>.3644 |
|               |              |                      | Mean 3.364           | Mean .03644          |
| 21            | Rambouillett | Side                 | 3.3                  |                      |

#14.

1620

| No. of Sample | Breed       | Sample obtained<br>from | Strength<br>gms. | Diameter<br>m.m. |
|---------------|-------------|-------------------------|------------------|------------------|
| 21            | Rambouillet | Neck                    | 3.8              | .0376            |
|               |             |                         | 3.9              | .0439            |
|               |             |                         | 3.35             | .033             |
|               |             |                         | 3.2              | .032             |
|               |             |                         | 3.15             | .0306            |
|               |             |                         | 3.2              | .031             |
|               |             |                         | 2.7              | .0279            |
|               |             |                         | 3.0              | .031             |
|               |             |                         | 2.8              | .0285            |
|               |             |                         | 2.8              | .0268            |
|               |             |                         | <u>31.90</u>     | <u>.3223</u>     |

Mean 3.19 Mean .032

|    |             |     |              |              |
|----|-------------|-----|--------------|--------------|
| 22 | Rambouillet | Jaw | 3.35         | .032         |
|    |             |     | 3.5          | .033         |
|    |             |     | 3.8          | .033         |
|    |             |     | 2.9          | .0297        |
|    |             |     | 1.4          | .0215        |
|    |             |     | 2.85         | .0279        |
|    |             |     | 2.7          | .0268        |
|    |             |     | 1.55         | .0225        |
|    |             |     | 3.1          | .032         |
|    |             |     | 2.9          | .031         |
|    |             |     | <u>28.05</u> | <u>.2894</u> |

Mean 2.805 Mean .02894

## Summary of the Rambouillette tests:

| No. of Sample | Breed       | Sample obtained from | Strength gms. | Diameter m.m. |
|---------------|-------------|----------------------|---------------|---------------|
| 12            | Rambouillet | Sheared Fleece       | 3.24          | .03571        |
| 13            | "           | Back                 | 2.79          | .03293        |
| 14            | "           | Sheared Fleece       | 3.29          | .03667        |
| 15            | "           | Hip                  | 2.814         | .03097        |
| 16            | "           | Thigh                | 3.63          | .03499        |
| 17            | "           | Sheared Fleece       | 3.69          | .03661        |
| 18            | "           | Belly                | 2.71          | .03415        |
| 19            | "           | Side ( )             | 3.5           | .03803        |
| 20            | "           | Side (1)             | 3.364         | .03644        |
| 21            | "           | Neck                 | 3.19          | .03223        |
| 22            | "           | Jaw                  | <u>2.805</u>  | <u>.02894</u> |
| Total         |             |                      | 35.023        | .37767        |
| Mean          |             |                      | 3.184-        | Mean .034334  |

The highest strength for a single fiber was 5.1 grams; lowest, 1.4 grams. The greatest diameter .0537 m.m.; smallest .0215 m.m. A sheared fleece, one from which the sample was taken without knowing from what part of the body it came, produced the highest average test, (3.69). The wool from the thigh and side ranks next, with records of 3.63 and 3.36 respectively. The weaker averages were those from the belly, back and jaw in the order named. The relation between the strength and diameter is upheld with a better degree of satisfaction in these tests than those made with the Cotwold fibers, the smallest fibers being in this case those from the jaw, neck and belly.

| No. of Sample | Breed      | Sample obtained from | Strength gms. | Diameter m.m. |
|---------------|------------|----------------------|---------------|---------------|
| 23            | Shropshire | Sheared Fleece       | 24.           | .0855         |
|               |            |                      | 27.           | .093          |
|               |            |                      | 23.2          | .0965         |
|               |            |                      | 25.6          | .091          |
|               |            |                      | 24.7          | .086          |
|               |            |                      | 26.5          | .091          |
|               |            |                      | 25.0          | .086          |
|               |            |                      | 18.0          | .083          |
|               |            |                      | 17.8          | .0806         |
|               |            |                      | 18.0          | .0795         |
|               |            |                      | 234.8         | .8721         |
|               |            |                      | Mean 23.48    | Mean .08721   |
| 24            | Shropshire | Sheared Fleece       | 17.2          | .052          |
|               |            |                      | 19.0          | .059          |
|               |            |                      | 19.6          | .0645         |
|               |            |                      | 16.3          | .047          |
|               |            |                      | 21.2          | .066          |
|               |            |                      | 18.4          | .059          |
|               |            |                      | 15.5          | .0467         |
|               |            |                      | 17.0          | .048          |
|               |            |                      | 18.4          | .056          |
|               |            |                      | 17.2          | .051          |
|               |            |                      | 179.8         | .5492         |
|               |            |                      | Mean 17.98    | Mean .05492   |

#17.

1623

| No. of Sample. | Breed                 | Sample obtained from | Strength gms. | Diameter m.m. |
|----------------|-----------------------|----------------------|---------------|---------------|
| 25             | Shropshire            | Sheared Fleece       | 21.0          | .0667         |
|                |                       |                      | 25.2          | .077          |
|                |                       |                      | 20.1          | .065          |
|                |                       |                      | 23.3          | .0725         |
|                |                       |                      | 31.2          | .086          |
|                |                       |                      | 23.0          | .096          |
|                |                       |                      | 18.2          | .061          |
|                |                       |                      | 19.8          | .0645         |
|                |                       |                      | 18.6          | .0639         |
|                |                       |                      | 14.2          | .059          |
|                |                       |                      | <u>214.7</u>  | <u>.6852</u>  |
|                |                       |                      | Mean 21.47    | Mean .06852   |
| 26             | Shropshire (yearling) | Sheared Fleece       | 19.4          | .0736         |
|                |                       |                      | 20.2          | .0698         |
|                |                       |                      | 19.0          | .0696         |
|                |                       |                      | 16.0          | .048          |
|                |                       |                      | 29.0          | .100          |
|                |                       |                      | 27.0          | .086          |
|                |                       |                      | 17.2          | .059          |
|                |                       |                      | 18.3          | .0688         |
|                |                       |                      | 17.7          | .066          |
|                |                       |                      | 16.8          | .049          |
|                |                       |                      | <u>200.6</u>  | <u>.6898</u>  |
|                |                       |                      | Mean 20.06    | Mean .06898   |

#18.

1624

| No. of Sample | Breed | Sample obtained from | Strength gms. | Diameter m.m. |
|---------------|-------|----------------------|---------------|---------------|
|---------------|-------|----------------------|---------------|---------------|

|    |                       |                |             |              |
|----|-----------------------|----------------|-------------|--------------|
| 27 | Shropshire (yearling) | Sheared Fleece | 14.0        | .0548        |
|    |                       |                | 15.2        | .063         |
|    |                       |                | 12.3        | .05          |
|    |                       |                | 12.4        | .053         |
|    |                       |                | 18.0        | .0698        |
|    |                       |                | 8.3         | .045         |
|    |                       |                | 12.7        | .053         |
|    |                       |                | 15.9        | .0645        |
|    |                       |                | 27.0        | .0818        |
|    |                       |                | <u>17.4</u> | <u>.0730</u> |
|    |                       |                | 153.2       | .6079        |

Mean 15.32 Mean .06079

|    |                       |                |             |             |
|----|-----------------------|----------------|-------------|-------------|
| 28 | Shropshire (yearling) | Sheared Fleece | 15.0        | .0537       |
|    |                       |                | 16.5        | .0645       |
|    |                       |                | 9.6         | .0478       |
|    |                       |                | 10.0        | .048        |
|    |                       |                | 9.6         | .047        |
|    |                       |                | 15.3        | .0537       |
|    |                       |                | 14.0        | .0505       |
|    |                       |                | 22.2        | .079        |
|    |                       |                | 16.4        | .062        |
|    |                       |                | <u>12.2</u> | <u>.049</u> |
|    |                       |                | 140.8       | .5562       |

Mean 14.08 Mean .05562

| No. of Sample | Breed     | Sample obtained from | Strength gms. | Diameter m.m. |
|---------------|-----------|----------------------|---------------|---------------|
| 29            | Southdown | Sheared Fleede       | 9.0           | .059          |
|               |           |                      | 8.5           | .0435         |
|               |           |                      | 8.9           | .051          |
|               |           |                      | 8.9           | .0376         |
|               |           |                      | 9.5           | .049          |
|               |           |                      | 11.0          | .0696         |
|               |           |                      | 11.7          | .076          |
|               |           |                      | 10.2          | .0667         |
|               |           |                      | 8.8           | .048          |
|               |           |                      | 6.9           | .0476         |
|               |           |                      | <u>91.4</u>   | <u>.5480</u>  |
| Mean 9.14     |           |                      | Mean .0548    |               |
| 30            | Southdown | Sheared Fleece       | 9.0           | .058          |
|               |           |                      | 5.7           | .0268         |
|               |           |                      | 7.2           | .044          |
|               |           |                      | 6.0           | .039          |
|               |           |                      | 7.6           | .048          |
|               |           |                      | 8.0           | .050          |
|               |           |                      | 9.0           | .057          |
|               |           |                      | 7.5           | .0457         |
|               |           |                      | 9.0           | .057          |
|               |           |                      | <u>11.0</u>   | <u>.0667</u>  |
|               |           |                      | <u>80.0</u>   | <u>.4922</u>  |
| Mean 8.0      |           |                      | Mean .0492    |               |

| No. of Sample | Breed     | Sample obtained from | Strength gms. | Diameter m.m. |
|---------------|-----------|----------------------|---------------|---------------|
| 31            | Southdown | Sheared Fleece       | 8.0           | .044          |
|               |           |                      | 18.0          | .0645         |
|               |           |                      | 6.2           | .032          |
|               |           |                      | 6.9           | .0376         |
|               |           |                      | 7.3           | .038          |
|               |           |                      | 11.5          | .053          |
|               |           |                      | 11.7          | .0537         |
|               |           |                      | 10.0          | .05           |
|               |           |                      | 7.5           | .0435         |
|               |           |                      | 9.1           | .049          |
|               |           |                      | 96.2          | .4653         |

Mean 9.62    Mean .04653

Summary of the Shropshire Tests.

| No. of Sample | Breed       | Sample obtained from | Strength gms. | Diameter m.m. |
|---------------|-------------|----------------------|---------------|---------------|
| 23            | Shropshire  | Sheared Fleece       | 23.48         | .08721        |
| 24            | "           | " "                  | 17.98         | .05492        |
| 25            | "           | " "                  | 21.47         | .06852        |
| 26            | "(yearling) | " "                  | 20.06         | .06898        |
| 27            | " "         | " "                  | 15.32         | .06079        |
| 28            | " "         | " "                  | 14.08         | .05562        |
| Totals-----   |             |                      | 112.39        | .39604        |

Mean 18.731    Mean .066006

## Summary of the Southdown tests.

| No. of Sample | Breed     | Sample obtained from | Strength gms. | Diameter m.m. |
|---------------|-----------|----------------------|---------------|---------------|
| 29            | Southdown | Sheared Fleece       | 9.14          | .0548         |
| 30            | "         | " "                  | 8.00          | .0492         |
| 31            | "         | " "                  | 9.62          | .04653        |
| Totals-----   |           |                      | 26.76         | .15053        |
| Mean          |           |                      | 8.92          | Mean .05017   |

In all the tests with the Shropshires and Southdown breeds the samples were obtained from sheared fleeces, as it was impossible at the time the experiment was being carried on to secure the wool from known places on the body. However, even with the limited amount of data some very important and interesting conclusions developed. One point especially noticeable in the Shropshire test is the lesser strength shown by the last two samples. The samples were taken from yearling Shropshire lambs. This would seem to indicate that wool on young sheep is finer and not so strong. The maximum and minimum strengths for the Shropshire fibers are 31.2 and 8.3 grams. The diameters ranged from .045 to .1 of a millimeter. The Southdown fibers ranged from 18.0 to 5.7 grams in strength and .076 to .0268 of a millimeter in diameter. The following is a table of comparison for the four breeds tested:

| Rank | Breed       | Av. Strength gms. | Av. Diameter m.m. |
|------|-------------|-------------------|-------------------|
| 1    | Cotswold    | 29.543            | .096              |
| 2    | Shropshire  | 18.731            | .066              |
| 3    | Southdown   | 8.92              | .050              |
| 4    | Rambouillet | 3.184             | .034              |

From these figures we may conclude: firstly,- That the tensile strength depends upon the breed and age, the coarser woolled breeds and older animals giving the greater tensile strength; secondly: that the strength varies directly with the diameter of the fiber, a factor which also depends upon the breed and age.