

being to the diameter of the fibre as 1 to 3·04; the fibres being on the average smaller, while the cavity is larger. 88 fibres from the Native samples were measured, and gave a mean diameter of '000603, and mean diameter of the cavity '000187, or in the proportion of 1 to 3·22.

B.—Machine-dressed Samples.

In the machine-dressed samples the bundles of fibres had to be more or less broken up, and in this way the samples were irregular, sometimes many of the ultimate fibres being separated, at other times the fibre being closely united in bundles. The characteristic of the machine-dressed sample is the great variation in diameter of the fibres, varying as they do from '00035 to '001, while the diameter of the cavity varies from '000075 to '000625. In these samples it was very evident that much of the fibre was of inferior quality, that the cavity was so large, and the wall so thin, that the ultimate cells could not be separated, and all attempts to separate them would result in the production of a large amount of waste. Taking the mean of 76 fibres from the machine-dressed samples, we get '000534 as the mean diameter of the fibre, and '000151 as the mean diameter of the cavity, the cavity thus being to the fibre as 1 to 3·53.

Taking the mean of all the fibres measured (164 in number) we get '000569 as the mean diameter of the fibre, and '000169 as the mean diameter of the cavity, or as 1 to 3·36.

§ 7.—MICROSCOPICAL CHARACTER OF PREPARED FIBRES OF MANILLA HEMP.

Manilla hemp occurs in coarse threads of varying size, which are the fibro-vascular bundles of the plant, removed apparently without any attempt being made to break up the bundles into their ultimate cells or fibres. In appearance the ultimate cells or fibres of Manilla hemp closely resemble those of *Phormium tenax*. They are cylindrical, with a large cavity in the centre. The fibre has, in general, a greater diameter than that of *Phormium*, but the cavity is always much larger. The following measurements show this:—

				Diameter of Fibre.	Diameter of Cavity.
A	...	...	...	'00065	'00025
B	...	...	...	'0007	'00035
C	...	...	...	'0008	'00045
D.	...	...	...	'00125	'0009

They are very variable in size and breadth of cavity, resembling very much a bad sample of *Phormium* fibre. The bundles can only with difficulty be separated into their ultimate fibres or cells, and when doing so for microscopical examination the fibre was nearly always injured, the cavity being easily destroyed.

The Manilla hemp consists of *prosenchymatous wood-cells*, and is, anatomically and physiologically, the same as the fibres of New Zealand flax.

A good deal of cellular tissue adheres to the bundles of fibres, but it is colourless, and there is no trace of epidermis or of cells containing chlorophyll, as in the case of *Phormium* fibres.

§ 8.—MICROSCOPICAL CHARACTER OF PREPARED FIBRES OF IRISH FLAX.

The ultimate bast-fibres of which the flax is composed are not united in large bundles, a few fibres only adhering, and in the specimens examined many of the fibres were quite free one from the other. The fibres appear as a greatly elongated cylinder, with a cavity sometimes well marked, sometimes scarcely visible, at other times wanting. Adhering to the fibres, and often more or less discolouring them, were fragments of tissue, sometimes the epidermis with stomata, from the stem; at other times the cells of the soft-bast or wood-cells from the central portion of the stem. The diameter of the fibre varies from about '0004 to '0006.

§ 9.—MICROSCOPICAL CHARACTER OF PREPARED FIBRES OF RUSSIAN HEMP.

Russian hemp differs entirely in appearance from Manilla hemp and New Zealand flax, but resembles Irish flax very much in its general character. The fibres are more or less separate, some entirely free, others in small bundles. The fibres vary very much in diameter, some being very broad, others narrow, and they appear like longitudinally striated cylinders. Sometimes a cavity exists, at other times none can be traced. The fibres are, on an average, from '0005 to '0007 in diameter, and in one fibre in which the diameter was '0007 the diameter of the cavity was '0001.

Some cellular tissue was observed adhering to the fibres, but they were cleaner than the fibres of Irish flax. Like Irish flax the hemp consists of bast-fibres, and is, anatomically and physiologically different from the fibres both of Manilla hemp and New Zealand flax.

§ 10.—NATURE OF THE SO-CALLED CEMENT.

The walls of all tissue-cells are constructed on the same type. We have first the primary cell-wall, a thin plate or lamella, composed of cellulose. In thickened cells the thickening material appears as a deposit on each side of the middle lamella, and in general this secondary wall has a different composition from that of the primary cell-wall or middle lamella. In the *Phormium* the primary cell-wall consists of cellulose, which is coloured blue by a solution of iodo-chloride of zinc (Busk's solution), while the secondary wall, making up the great mass of the cell, consists of ligneous matter, and is coloured yellow with Busk's solution. If, therefore, a thin section of the bundle of *Phormium* fibres be treated with Busk's solution, the so-called cement is shown to consist of cellulose, and is coloured blue, while the great mass of the fibre is stained yellow. The cellulose, which forms the primary cell-wall, is that which is soluble in chlorate of potash, and nitric acid (Schultz' process). All the different fibres, Manilla hemp, Russian hemp, and Irish flax, are united in the same way. As this