of the fat-tailed ancestry of present-day sheep, Prof. Ewart noted some time ago a Border-Leicester sheep with the tip of the tail turned up following the lines of the tail of the fat-tailed sheep. Thus it would appear that the nine brief statements with which the report starts are of quite extraordinary interest, and in addition may usefully be kept in mind when studying present-day types of sheep.

Mendelian principles—particularly involving the reshuffling of "characters"—are then insisted on and the value of crosses beyond the first cross emphasised. This is really essential, as so many breeders fail to realise the importance of the F_2 cross. Australian sheep-breeders, however, say "three generations to obtain the cross and thirty to fix it"!

The report is then divided into two sections: (1) experiments with Highland blackface and other modern breeds; and (2) experiments with primitive breeds. It is pleasing to note the assistance accorded by the Duke of Richmond and Gordon and his agent, Mr. R. A. Dawson, Mr. R. Macmillan, Captain J. Stirling, Mr. Dyson Perrin, Sir John Ramsden, Sir Malcolm Macgregor, Mr. Gordon, and the veteran of experimental sheep-breeders, Mr. J. Elwes of Colesborne, Cheltenham.

The Scottish Board of Agriculture is also taking a deep and broad interest in experiments here partially recorded. Ten photographs of typical sheep and their crosses add materially to the value of the report.

The report concludes with references to the experiments in progress under the direction of Prof. White in Wales and to the experiments on British wool characteristics at present being carried out at the University of Leeds. A. F. B.

The Organisation of Knowledge.

CURIOUS reflections on the present state of scientific knowledge are suggested by the extraordinarily interesting address of Dr. F. L. Hoffman to the social and economic science section of the American Association, at the Toronto meeting last December, on "The Organisation of Knowledge," published in *Science* of March 10 and 17. Dr. Hoffman has been for thirty years a very practical organiser of knowledge in connection with his management of the Prudential Insurance Company of America. He has been reading Prof. Whitehead's "The Organisation of Thought," and it seems to have impressed him with a sense of the remoteness of mathematical principles, mathematical methods, and mathematical research from any organisation of science which is serviceable in practical life.

The problem Dr. Hoffman deals with is a profound one, and carries us back to the old distinction between truths of reason and matters of fact which in some form has been the problem of modern philosophy since it first arose with Bacon and Descartes. It is interesting to look back on the confidence with which some of the leaders of philosophic thought in the nineteenth century supposed they had solved it. The confidence appears first in Comte and afterwards in Spencer, who devoted a great part of his intellectual energy to an attempt to give it practical effect. It rested on the idea of a division of labour. It was to be the business of scientific workers to observe and collect facts, guided of course by certain rules of classification and arrangement, but it was to be the special business of philosophers to systematise and generalise. An amusing illustration is a story related to the present writer many years ago by the late Dr. Williamson, professor of chemistry in University College. Herbert Spencer had written to him to ask him whether certain specified chemical experiments could be relied on as correct. In his reply he added to the information asked for his own interpretation, only to receive by return a sharp rebuke pointing out to him that his business was to observe and report facts; it was for the philosopher to theorise concerning them. It is perhaps needless to add that the narrator saw no humour in the story.

The fact gatherer, Dr. Hoffman tells us, should be the fact user. It is the reason he gives for this, however, that deserves particular attention. Fact gathering is impossible without imagination, and imagination is what the mathematician is ever trying to get rid of. The ideal of science is forecasting, and in the business of insurance we have the most complete development of it. In the organisation of knowledge for insurance the whole principle is that all facts are regarded in their interrelation or interdependence for useful purposes. Dr. Hoffman contrasts this with Prof. Whitehead's appeal for a first-hand knowledge which has "never been scared by facts." Progress and discovery depend upon a disciplined imagination, and Dr. Hoffman quotes Karl Pearson, "the man with no imagination may collect facts, he cannot make great discoveries." What we want to forecast are the sort of things mathematics is helpless before, things like the international war, or the influenza epidemic.

Dr. Hoffman concludes his address by outlining the general scheme of his own organisation of the library and information service of his business office.

The Centenary of Naval Engineering.

UNDER this title an interesting paper was read at a meeting of the Newcomen Society on March 30 by Engineer-Commander Edgar C. Smith. Among other matters treated was the development of paddle-wheel vessels, and a notable feature is presented by two tables giving particulars of steam vessels added to H.M. Navy during the period 1820-1850.

During the first twenty years all Navy boilers were of the flue type and were box-shaped. Leakage was very frequent; Dinnen remarks on the numerous "weeps" of which no notice was taken. These boilers were suitable for low pressures only, and it was forty years before the working pressure increased from 3·5 to 20 lb. per sq. in.

Great care was necessary for working these early boilers with salt water. Ships at sea put out the fires every third or fourth day and emptied the boiler. Afterwards, blowing down every two hours became the rule. If the blow-down cocks jammed, the water could be blown through the hand pump, or, according to Murray, "a usual plan is to knock out a rivet from the bottom of the boiler." Feed heating came into use early, an annular tank being placed round the funnel.

The first vessel in the Navy to have a surface condenser was the *Megaera*. She had the five-fold combination of an air-pump, a circulating pump, a surface condenser, an evaporator, and a steam saver. This vessel was wrecked in 1843. The oscillating engine was invented by Murdock, improved by Manby, taken up by Maudslay, and its final success was due to Penn. Since all warships had to retain their sailing qualities, special attention had to be paid to devices for preventing interference from the paddle-wheels whilst the vessel was under sail.

We are indebted to the *Engineer* for the foregoing details, and trust that the author will complete his work by another paper dealing with the development of screw propulsion.