

of light and air alone, without the aid of any human agency; but it is to be regretted that literary works of value and even documents of great importance are still written and printed upon materials whose perishable nature is not taken into account.

"The durability of ancient books is very remarkable. The productions of the very earliest presses have come down to us as bright and clear and solid as when they were first printed. The paper is tougher and the ink as black as in works of the present day. The books which Columbus read may now be read as easily as when they were first printed, and the notes he made on their margins are as legible as when he wrote them. The entries in the custom-house records of the reward paid for discovering America are still black; but upon the receipt for the amount paid in the Alabama award, some of the endorsements have turned brown and are fading away.

"The perishable character of recently printed books is due mainly to two causes—the use of wood pulp not thoroughly prepared and the introduction of heavily clayed glossy papers necessary for printing photographic process blocks of low relief. The defective material in these last papers is covered up by the clay with which the interstices are filled and the surface covered. The weight of the paper is increased by the heavy loading, but a fold across the corner of a sheet will show that its brittleness is increased in proportion.

"The danger of using paper made from wood for important documents was soon observed in Germany where such paper came first into use and, because of its cheapness, was very generally employed. The Prussian government took up the matter and made very stringent laws upon the

subject. It established standards of quality, and enacted that all papers for permanent documents should be submitted to official tests. The issues of the German publishers for a number of years (until in fact quite recently when these conditions came to be appreciated) show abundant evidence in their brown margins and brittle edges of the perishable nature of the paper used.

"It is not, however, to be assumed that paper made with the admixture of wood pulp is to be condemned if the resinous matter is eliminated and only the wood cellulose remains. It is not likely that we shall ever again use paper so durable as that used when printing was first invented. The papers of those old days were made of linen, cotton and hemp fibres, and these materials are as enduring now as ever, but modern taste insists on their being bleached to a higher degree of whiteness, and as will be shown later on, the traces of the bleaching agents left tend to decompose the writing inks in common use. What requires to be guarded against in the printing paper of government, is the admixture of mechanically ground wood pulp and the insufficient conversion by chemical methods of wood into wood cellulose.

"It has been asserted, but not proved, that cellulose derived from wood, even if pure, is different in its properties from cellulose derived from linen and cotton, and that any admixture of wood pulp is fatal to the permanence of paper. There can, however, be no question of the superiority of linen and cotton paper; the experience of many hundred years has established its unchanging endurance, but on the other hand there are many reasons for believing the two groups of cellulose to be at least chemically identical, and, if so, the question re-