humidity also should be controlled to some extent. It is probable that a control of relative humidity within a range of 10 per cent. (plus or minus 5 per cent.) would be satisfactory.

There is no evidence that state of cure influences to any great extent the effect of either temperature or relative humidity. Gum stocks seem to be affected slightly more than heavily compounded stocks. The effect of relative humidity and temperature was not influenced by the type of accelerator or the softener used in the compound.

The first phase of the work consisted in a study of the effect of humidity and temperature after vulcanization and during testing. The compounds were conditioned two and six days. Two days represent the usual time in commercial practice, while the six-day exposures were made to get nearer the maximum effect.

The next phase of the work is to determine the effect of humidity and temperature upon the unvulcanized compounds. The compounds will be mixed at the bureau and carefully conditioned over ranges of relative humidity and temperature before vulcanization. After vulcanization the specimens will receive uniform conditioning as to temperature and humidity to determine the effect of the varying conditions previous to vulcanization.

The results in detail will be reported to the rubber section of the American Chemical Society when the second phase of the work has been completed.

MANILA ROPE WASTE FOR PAPER MANUFACTURE.

PAPER-MAKING tests have recently been made at the Bureau of Standards to determine the suitability of manila rope waste for paper manufacture. The waste employed in the experimental work was refuse fibre from the manufacture of manila cordage at the rope walk of the Boston Navy Yard. At present, little, if any, of the waste derived from manila hemp at cordage mills is used commercially, most of it being burned under the boilers as fuel. The experimental tests were made with a view to finding a profitable use for the refuse fibre of the cordage industry.

Manila hemp (*Musa textilis*) is obtained from the leaf stalks of a plant of the banana family and is one of the principal products of the Philippine Islands. The fibre is tough and strong and is used primarily for textiles and cordage. The material used in

the paper industry is obtained almost entirely in the form of old rope, and the papers produced from it are commonly called "rope" papers. Rope papers are characterized by great strength, toughness, and wearing qualities, and are ordinarily used for shipping tags, wrappers, bagging, etc., in which strength is essential.

The pulping and paper-making operations employed in the experimental tests on the waste were those commonly used in paper manufacture. Soda ash was the digesting agent that gave best results. Tests on kraft and sulphite wood pulps and on old rope stock were included for comparison. A good yield of paper-making was obtained from the waste and the paper produced was of sufficient strength for a variety of uses. Measurements on the finished paper indicate that manila rope waste does not compare favorably with old rope stock but is considerably better than sulphite wood pulp.

A complete report of this work was published in *Paper Trade Journal,* May 5, 1927.

LIGHT-COLORED FIRST-COAT ENAMELS FOR SHEET IRON.

IT IS very common practice in the manufacture of vitreous enamel-coated sheet iron and steel articles to apply first a coating which is a dark color, and over this to apply two coats of white enamel to give the desired brilliant white finish. The first coat is dark because it contains cobalt and other oxides which enhance its ability to adhere to the iron, but if a white first coat can be applied which is sufficiently adhesive, a total of two coats will suffice and a saving in manufacturing costs results. There is now in progress at the bureau an investigation to eliminate the necessity for the dark first coat, either through development of a light-colored enamel which by virtue of its composition has an adhesiveness comparable to that of a cobalt enamel, or through improving the technique of application so that a white enamel will adhere sufficiently, or both.

Several different opacifying materials, added in the raw state to the enamel glass before grinding, have been studied to determine their suitability for use in a first coat. These materials included tin oxide, zirconium oxide, zirconium silicate, and sodium antimonate. Of these sodium antimonate and zirconium oxide gave promise of satisfactory behavior for this use.