as the sulphates of lime are difficult to remove, most phosphate powders contain this impurity. Also if commercial sulphuric acid is used to decompose the bones notable quantities of lead and arsenic may be introduced into the baking powder. If the acid phosphate is pure there is no objection to its use in baking powders. The result of the decomposition of a phosphate powder is soluble phosphate of soda and insoluble phosphate of lime. The U. S. Dispensatory states: "Phosphate of soda is mildly purgative in doses of from one to two ounces. Its physiological action is therefore comparatively slight. Phosphates of calcium are probably neutral so far as their direct action on the stomach is concerned. The makers of phosphate powders claim that the use of such powders restores the phosphoric acid present in the wheat, which is largely removed in the preparation of flour. It is doubtful if this claim can have any weight, as the supply of phosphates is more than made up in other foods.

Sesqui carbonate of ammonia has been used to some extent, and one of the most widely advertised brands of baking powders contains a small quantity of it. It is a compound which should be used with great caution. The ammonia salts are much more irritating than the corresponding potash or soda salts. The National Dispensatory says of carbonate of ammonia: "It is irritant, and if long continued, even in doses which the stomach will tolerate, it impairs nutrition. In doses of five to ten grains, it increases the fullness and force of the pulse and causes a sense of lightness in the head. It is one of our most powerful medicines, and certainly should not be used in the preparation of foods."

ALUM BAKING POWDER.

The call for a cheap baking powder has caused the powders made with alum to come into extensive use. The healthfulness of these alum powders is seriously questioned, and several careful investigations have been made, bearing on this point. It is universally conceded that alum itself, when added to bread, is injurious to health, and that the
small amount sometimes added to flour to improve the appearance of the bread made from it, should be decidedly prohibited. Since the introduction of baking powders made from alum and bicarbonate of soda, there has been much dispute as to the actual healthfulness of the residue left in the bread made with such powders. The alum used in these powders is what is known as ammonia alum, and is a double sulphate of ammonia and aluminum. This salt when mixed with bicarbonate of soda in the proper proportions, is decomposed and carbonic acid, sulphates of soda and ammonia, together with hydrate of alumina are formed. This residue is more complex than with any of the powders previously described. There is but little known of the physiological action of sulphate of ammonia; but it is probable that it possesses the same irritating qualities of the other ammonia salts. Sulphate of soda is the well-known Glauber's salts and its action as a purgative is well-known. The question is further complicated by the fact that some powders contain tartaric acid or acid phosphate of lime in addition to the alum. These powders give an entirely different residue from the straight alum powders. The addition of tartaric powders is decidedly objectionable. If the acid is added in sufficient quantity to a straight alum powder, it prevents the formation of the insoluble hydrate of alumina when the powder is moistened, and the effect would be the same as if alum or other soluble salt of aluminum were taken into the stomach.

The use of acid phosphate of lime in place of tartaric acid is a decided improvement. The residue from an alum phosphate powder is a mixture of phosphate of aluminum, sulphate of lime, sulphate of aluminum, sulphate of soda. There is no doubt that the soluble salts of aluminum are injurious when taken into the stomach.

Of the physiological action of the hydrate and phosphate of aluminum there has been much doubt, but the recent investigations of Prof. J. W. Mallet would indicate that although hydrate of alumina is an insoluble substance, yet it may have a decided action on the process of digestion. From a long series of experiments with alum powders and
their residues, Prof. Mallet draws the following conclusions: (a) The greater part of the alum baking powders in the American market is made with alum, the acid phosphate of calcium, bicarbonate of sodium and starch; (b) These powders as found in the retail trade, give off very different proportions of carbonic acid gas and therefore require to be used in different proportions with the same quantity of flour; some of the inferior powders in largely increased amount to produce the required porosity in bread.

(c) In these powders there is generally present an excess of the alkaline ingredient, but this excess varies in amount and there is sometimes found an excess of acid material.

(d) On moistening with water these powders, even when containing an excess of alkaline material, yield small quantities of aluminum and calcium in a soluble condition.

(e) As a consequence of the common employment of calcium acid phosphate with alum, in the manufacture of baking powders, these, after use in bread-making, leave most of their aluminum in the form of phosphate. When alum alone is used, the phosphate is replaced by hydroxide.

(f) The temperature to which the interior of bread is exposed in baking does not exceed 212° F.

(g) At the temperature of 212° F., neither the "water of combination" of aluminum hydroxide nor the whole of the associated water of either this or the phosphate, is removed in baking bread containing these substances.

(h) In doses not very greatly exceeding such quantities as may be derived from bread as commonly used, aluminum hydroxide and phosphate produce, or produced in experiments upon myself, an inhibitory effect upon gastric digestion.

(i) This effect is probably a consequence of the fact that a part of the aluminum unites with the acid of the gastric juice and is taken up into solution, while at the same time the remainder of the aluminum, hydroxide or phosphate throws down in insoluble form the organic substance constituting the peptic ferment.
(k) Partial precipitation in insoluble form of some of the organic matter of food may also be brought about by the presence of the aluminum compounds in question.

(l) From the general nature of the results obtained the conclusion may fairly be deduced that not only alum itself but the residue which its use in baking powder leaves in bread, cannot be viewed as harmless, but must be ranked as objectionable, and should be avoided when the object aimed at is the production of wholesome bread.

The results of Mallet’s experiments would indicate that the residues in bread made from alum baking powders have a decided effect even on a strong and healthy stomach. The weight of testimony is certainly against the use of alum, but the data are not yet sufficient to absolutely prohibit its use.

The following table shows the brands which have been examined and gives a good idea of the kind and quality of powders sold in the state. It will be noticed that there is a great variation in the per cent. of carbonic acid present, and consequently in the leavening power of the different powders. Some of the brands would be dear at one-fourth of the price at which they are sold.