

UNITED STATES PATENT OFFICE.

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ART OF TREATING STARCH MATERIAL.

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To all whom it may concern:

Be it known that I, ALEXANDER P. ANDERSON, a citizen of the United States of America, residing at New York, in the State of New York, have invented certain new and useful Improvements in the Art of Treating Starch Materials; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to the art of treating all kinds of starch materials—that is to say, starch or materials containing starch or mixtures of both.

The objects of my invention are to provide a dry method of swelling starch materials of all kinds to render them porous, thereby enhancing their nutritive value and rendering them more readily and completely digested than when used in their present form and rendering them more valuable otherwise in the arts—forexample, for sizing and as pastes.

My invention is based on the discovery which I have made that the liquid generally assumed to be composed mainly of hygroscopic water contained in the starch granules of all starch materials when in a substantially air-dried state may be utilized to expand or swell the same evenly and homogeneously in all directions, thus loosening the starch particles and rendering the starch exceedingly porous, so as to be readily digested and readily taken up by liquids. This action takes place whenever the liquid is caused to suddenly change to the gaseous condition, or, in other words, to explode, with such rapidity that the same cannot escape with sufficient speed by diffusion through the coatings of the starch granules. These coatings of the starch granules are composed of what is known as "starch cellulose," and it is a part of my discovery that the same will retain the gases within the granules to a sufficient extent to cause the explosive action above referred to if a method be devised whereby the liquid contained in the granules passes into the gaseous state with sufficient rapidity.

In carrying out my invention I preferably heat any "starch material," under which term when used in the specification and claims I comprise starch of all kinds and all sub-

stances and products containing starch—such, for example, as cereals of every description and every kind of amylaceous seeds or kernels—under gas-pressure—such, for example, as air-pressure—to a point above the boiling-point of the liquid contained in the starch granules at normal atmospheric pressure, or, what is practically the same thing, above the boiling-point of water at normal atmospheric pressure, for a period of time not long enough to permit the escape of too much of the liquid contained in the granules through the granule coatings by diffusion. I thereupon while substantially maintaining the said temperature release or remove the pressure from the starch materials with such rapidity that the liquid will suddenly burst or flash into gaseous form or steam, which will result in an instantaneous expansion or explosion of the entire mass of the starch material into several times its original volume, the said material being evenly and homogeneously swelled into a very porous mass. This expansion is such that the grains or lumps composed of an aggregation of numerous granules, or, in the case of cereals or seeds, each kernel preserves its exact original shape and becomes a very much enlarged and porous copy of the original body, provided the heat applied be sufficient to render the granule-material sufficiently coherent after the explosion. What I consider the best temperature for this purpose is given below, and it is probable that such temperature softens the starch cellulose sufficiently to become adhesive or sticky.

It should be observed that it is within the scope of my invention not only to quickly remove the entire pressure upon the starch material while heated to a certain temperature under such pressure, but also to merely reduce the said pressure to a point sufficiently below the point at which the liquid contained in the granules will boil at such temperature to cause the same to suddenly burst into a gaseous condition. The important point under all conditions is to heat the starch material under any pressure and thereafter while the same is thus heated to suddenly reduce said pressure sufficiently below the point at which the liquid boils at the temperature imparted to cause the same to suddenly gasify;