UNITED STATES PATENT OFFICE.

ERICH SCHWANENBERG AND ALBERT RINNE, OF HANOVER, GERMANY.

PROCESS FOR HARDENING CALCAREOUS ARTIFICIAL-STONE SUBSTANCES BY MEANS OF CARBONIC ACID.

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To all whom it may concern:

Be it known that we, ERICH SCHWANENBERG, a subject of the King of Prussia, residing at Hanover, Germany, and ALBERT RINNE, a subject of the King of Prussia, residing at Hanover, Germany, have invented certain new and useful Improvements in Processes for Hardening Calcareous Artificial-Stone Substances by Means of Carbonic Acid, of which the following is a specification.

Numerous processes have already been proposed for hardening artificial-stone substances, containing hydrate of lime, by means of carbonic acid or gases containing the same. Thus, it has been proposed to let the gases coming from lime-kilns or the like act directly on the artificial blocks. This process is not desirable however, as the blocks produced turn out soft and of inferior quality, because with the changeable temperature and composition of the kiln-gases, as they come from the kiln during its activity, the hardening of the stones can not be properly regulated. It has been proposed, also, to treat the artificial blocks with carbonic acid at ordinary temperature, under gradually increasing pressure, in such manner that a constant temperature of about 32° C. is produced and maintained, with the object of securing a thorough action of the carbonic acid; again it has been suggested that a carbonic acid of very high percentage be used, in order to effect a very rapid hardening and drying of the blocks. In these latter processes, the disadvantages of the first is that it necessitates strongly built vessels and that the blocks must be dried beforehand. In addition, this process seems to necessitate the use of carbonic acid of high percentage. The latter objection applies also to the second process. It has been found also in this connection, that the high temperature produced by the combination of the carbonic acid with the lime falls rapidly, because the reaction very soon abates in consequence of the newly-formed calcium-carbonate surrounding the hydrate of lime. A sufficient evaporation of the resultant water cannot take place therefore, and a thorough action of the carbonic acid upon the blocks is prevented. It has been proposed also to treat the blocks alternately with carbonic acid at ordinary temperature and air, in order to effect a thorough action of the carbonic acid. We are likewise aware that with the same object in view the blocks have been subjected to the alternate action of heat and a mixture of vapor and carbonic acid gas.

Our invention consists of an improvement upon this last mentioned method and is distinguished therefrom by the omission of vapor from the carbonic acid gas. We thereby do away with the necessity for evaporating the moisture which is absorbed from the mixture of vapor and carbonic acid which is used in the old process, and limit the evaporation to the elimination of the reaction waters formed during the treatment of the blocks with the carbonic acid gas.

As compared with the uninterrupted action of hot lime-kiln-gases or concentrated carbonic acid, our process has the advantage that the rate of drying can better be regulated to preserve the slight moisture of the block necessary for the favorable action of the carbonic acid. While on the other hand we secure the highly desirable end, that the reaction-water which forms and stops the pores of the block thereby impairing the action of the carbonic acid, is driven out in a simpler, surer and more rapid manner than in the prior processes.

The warming of the blocks may take place by means of radiating heat, in which case the vapors which form, may be sucked or carried off by a current of neutral gas. Any suitable means may be used however, as for instance by leading in a current of warm air or the like neutral gas.

The carbonic acid may be of any desired origin and may be used in a condition of greater or less concentration.

The blocks to be treated may consist of hydrate of lime or a mixture of hydrate of lime with calcium, carbonate or magnesium carbonate, such as limestone, dolomite, magnesite, etc., and when desired in mixture with coloring matter, mineral "filling" substances. By hydrate of lime, in the present practical case, is meant slaked burnt lime or burnt substances (such as, for instance, hydraulic lime treated with water) containing quicklime, treated with water.

We claim as our invention—

1. The process of hardening artificial stone substances, containing hydrate of lime,

by means of comparatively dry carbonic acid or gases containing carbonic acid, which consists in alternately treating said substances with said carbonic acid and heating the same to remove the water formed by said treatment.

2. The process of hardening artificial stone substances containing hydrate of lime which consists in subjecting the lime to the alternate action of comparatively dry carbonic acid and a heated neutral gas to remove the reaction waters, substantially as described.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses.

ERICH SCHWANENBERG.
ALBERT RINNE.

Witnesses:
ALFRED SCHWANENBERG,
PAUL P. THOMPSON.