A PRACTICAL TREATISE ON THE PREPARATION, COMBINATION AND APPLICATION OF CALCAREOUS AND HYDRAULIC LIMES AND CEMENTS: TO WHICH IS ADDED MANY USEFUL RECIPES FOR VARIOUS SCIENTIFIC MERCANTILE AND DOMESTIC PURPOSES

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649060627

A Practical Treatise on the Preparation, Combination and Application of Calcareous and Hydraulic Limes and Cements: To Which Is Added Many Useful Recipes for Various Scientific Mercantile and Domestic Purposes by James G. Austin

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

www.triestepublishing.com

JAMES G. AUSTIN

A PRACTICAL TREATISE ON THE PREPARATION, COMBINATION AND APPLICATION OF CALCAREOUS AND HYDRAULIC LIMES AND CEMENTS: TO WHICH IS ADDED MANY USEFUL RECIPES FOR VARIOUS SCIENTIFIC MERCANTILE AND DOMESTIC PURPOSES

Trieste

A PRACTICAL TREATISE

ON THE

PREPARATION, COMBINATION AND APPLICATION

OF

CALCAREOUS AND HYDRAULIC LIMES AND CEMENTS,

COMPILED AND ARRANGED FROM THE BEST AUTHORITIES, AND FROM THE PRACTICAL EXPERIENCE OF THE COMPILER DURING A LONG PROFESSIONAL CAREER,

TO WHICH IS ADDED MANY

USEFUL RECIPES FOR VARIOUS SCIENTIFIC, MERCANTILE AND DOMESTIC PURPOSES.

BY

JAMES G. AUSTIN,

ARCHITECT.

NEW YORK:

JOHN WILEY & SON,

15, ASTOR PLACE.

1871.

PREFACE.

The following pages (which make but little pretensions to originality) are presented to the notice of the Building Profession, as a concise and useful work upon the important subject of Limes and Cements, and with a view to attract public attention to their essential properties, analysis, combination and application, as described in a rare, but highly esteemed and valued work (long since out of print) by Dr. Brindley Higgins, the theories and experiments therein enunciated and defined having been practically confirmed by the compiler, during a long professional career, and also as embodying the best modern experience and information upon the subject, derived from high authority (which is duly acknowledged) interspersed with practical remarks by the Author, to which is added much that is useful to the engineer, geologist, and American citizen, and now humbly and respectfully submitted to the patronage of an enlightened public.

March, 1862.

GENERAL REMARKS.

CEMENTS are of two distinct classes, viz., *Calcareous*(or those which are used for works exposed to the air;)and *Hydraulic*,(or such as are used under water;)they are also further distinguished as *Hot* and *Cold*. The former are those which are applied by the aid of heat or fire, and which contain, rosin, resin, bees-wax, and such like substances; and the latter, those which are applied through the medium of alcohol, water, or oil, and are chiefly composed of calcareous and other earthy matters.

CALCAREOUS Cement or mortar is a most important auxilliary in the construction of every description of brickwork, and masonry, and is universally known by the term "mortar."

HYDRAULIC Cements are those whose property is to indurate or to harden under water, and are consequently indispensable in the construction of bridges, docks, quays, and other marine works.

PLASTIC Cements are such as are more particularly applied to the stuccoing or incrustation of the exterior and interior surfaces of walls, &c., the use of which is more applicable to the plasterer's art.

The above three classes or divisions will be separately treated and explained, in consecutive order—but before entering into the description of the composition of either of them, it would be necessary first to consider and to define the nature, properties, and qualifications of the several ingredients of which ordinary mortar is composed, and to describe the principal varieties in use, pointing out the relative use and value of each, and then to describe the proportions of the several ingredients, and afterwards to explain the mode of combining and applying them to building purposes.

COMPONENTS OF MORTAR.

LIME.—Of this important ingredient there are numerous varieties possessing different qualities and merit. They are prepared from the following minerals, viz.: marble, limestone (of which there are several varieties), chalk, oyster and other shells, and also from other calcareous or carboniferous stones, which, when subjected to a red heat and calcined, will dissolve and effervesce with acid; and as a general rule it may be remarked that the harder the stone or other material is, the better will be the quality of the lime, and that which dissolves the quickest, heats the most in slaking, and falls into the finest powder, *is the best.*

Lime is usually found in connection with an acid, and by subjecting it to a red heat the acid is evolved, leaving the lime in a pure state, which is then termed *caustic or quick lime*, and is then fit for admixture with the other ingredients to form mortar or cement.

Of the method of preparing lime from the crude material, it will be irrelevant here to speak, but the operation will be found amongst the "addenda" at the end of this treatise.

Lime should be used fresh from the kiln, or otherwise it must be secured from the air, in close casks or other receptacles, till required for use, or it will by exposure readily absorb the carbonic acid gas from the atmosphere, to discharge which is the principal object of burning or calcining it; and lime, when once it is slaked, should be immediately used or it would become *effete* or dead, or for all cementitious purposes, perfectly useless.

Limestones lose about four-ninths of their weight in burning, though they shrink but little, but when properly burnt and slaked to a powder, they acquire nearly double their former bulk.

Chalk and lime stones if equally fresh and well burnt, differ but little in their cementitious properties, but as slaked lime absorbs carbonic

gas in proportion to its texture (solidity), so it yields its cementing properties the more freely by exposure; therefore, although stone and chalk limes be equally good at first, yet there will exist a great difference, subsequently; because the latter becomes more readily affected or injured by the atmosphere than the former, upon which fact, the preference for stone limes has been obtained.

Dr. Higgins in his work on "Calcareous Cements" &c., section 2, entitled "Experiments and Observations on Limestone and Lime," makes the following observations (the result of practical experiments) upon the properties of limestones, chalk and lime:—

Observation 1. *Limestone or chalk* heated only to redness, in a covered crucible, or a perforated one, through which the air circulates freely, loses only about one-fourth of its weight, however long this heat be continued. The sort of lime so formed, effervesces considerably in acid, slakes slowly and partially to a gray or brown powder, and heats but little in slaking; by *heat* is meant that degree of it which the bodies themselves (limestones, &c.) are made to conceive equally through their whole mass during the operation of burning.

Obs. 2. *Limestone or chalk* exposed to a heat barely sufficient to melt copper, whether in a perforated crucible or otherwise, loses about one-third of its weight in twelve hours, and very little more in any longer time. This lime effervesces but slightly in acids, heats much sooner, and more strongly than the former when wetted, and slakes more equally and to a whiter powder. In a variety of trials this lime equalled the best specimens prepared in common lime- kilns, and the amount of acidulous gas obtainable from each by a stronger heat, or in solution, were nearly equal; they slaked in like periods, with the same phenomena, color, and condition of powder.

Obs. 3. The lime burned in perforated crucibles, or in the naked fire, is whiter than that burned in common crucibles, covered, in which latter case the air has not free access to it, although the loss of weight be the same in both; but this latter kind of lime, in slak-

ing, affords as white a powder as any other which has lost equally of its weight. Whatever portion of phlogiston it retains to produce the dusky color, it is either detached in slaking, or does not sensibly affect the lime in any use to which it may be applied.

Obs. 4. When dry chalk or limestone is used in the process above described for making lime in close vessels, and for examining the matter which is expelled by fire, the quantity of water obtainable from it by heat is so inconsiderable as to deserve no notice in the calculation of that matter.

Obs. 5. Chalk or limestone heated gradually in close vessels loses very little acidulous gas until it begins to redden, after which the elastic fluid issues from it quicker as the heat increases, and so continues until the vessel attains a heat sufficient to melt steel.

Obs. 6. Forty-eight ounces of chalk yield twenty-one ounces of elastic fluid, the first issues of which are turbid, but soon become clear without loss of bulk, by the condensation of the aqueous fluid; the remaining portions being transparent and invisible, one thirty-sixth part of this elastic fluid, and sometimes even more, is phlogistic air, the residue, pure acidulous gas.

Obs. 7. The residuary lime of forty-eight ounces of chalk, heated to the total expulsion of the elastic fluids, weighs only twenty-seven ounces, when red-hot, but when cool it weighs more, by reason of the air which it absorbs as the heat escapes from it.

Obs. 8. When no more heat is employed than necessary to expel these elastic fluids, the residuary matter is sensibly diminished in volume, and is good lime, though not so white as lime prepared in the usual way; it slakes readily with water, and grows very hot and perfectly white. The slaked powder is exceedingly fine, except from those parts of the lime which lay in contact with the retort, which are always superficially vitrified, because clay and lime promote the vitrification of each other.

Obs. 9. The lumps of this lime, immersed in lime-water, or boiling