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METHOD FOR TREATING ARGILLACEOUS MATERIAL

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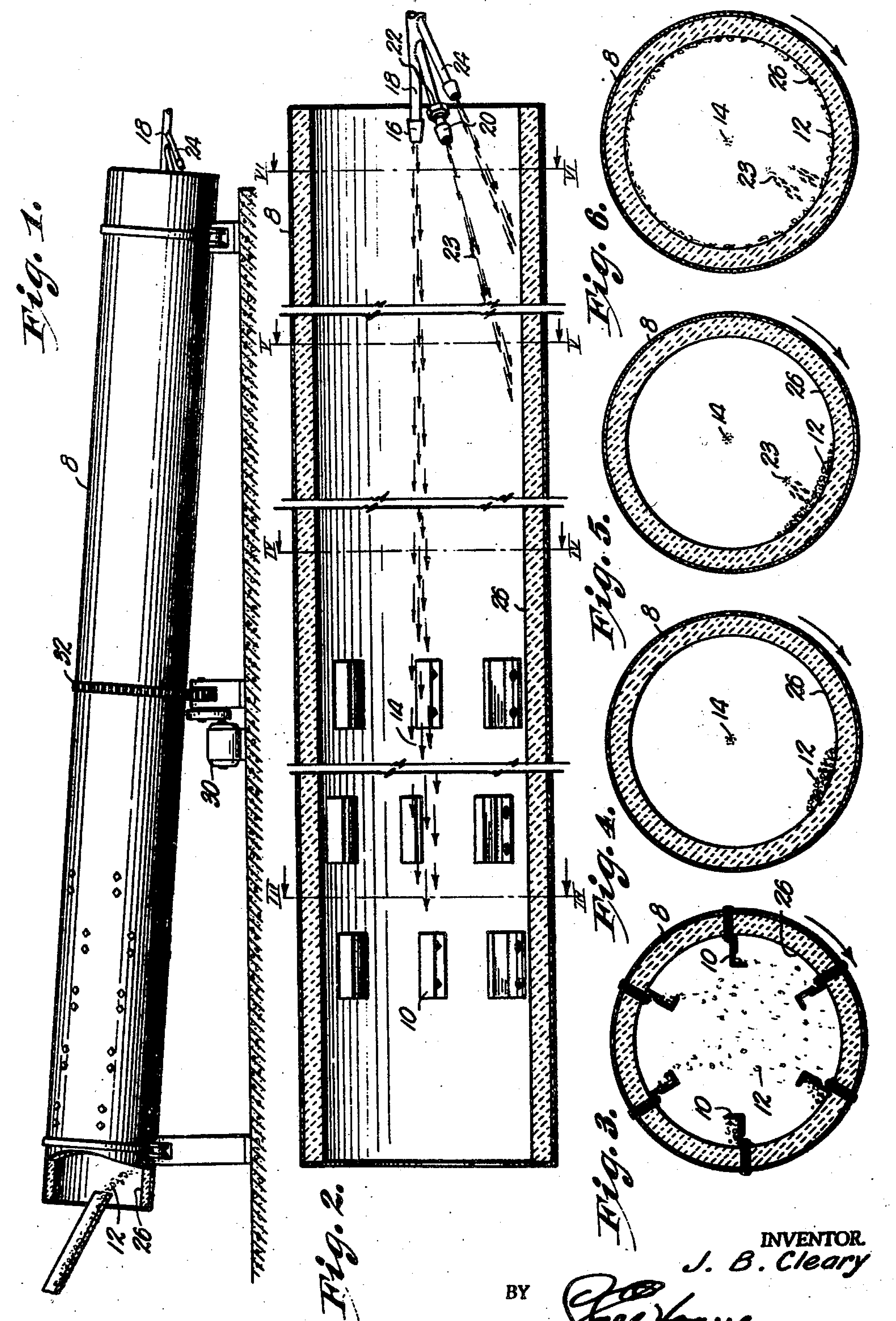

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METHOD FOR TREATING ARGILLACEOUS MATERIAL

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2 Claims. (Cl. 252—378)

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This invention relates to a method for manufacturing light weight aggregate from raw material of argillaceous character, which, upon being burned, will harden to form clinkers that are subsequently crushed and mixed with a suitable cementitious substance, as suggested in Patent No. 1,707,395, dated April 2, 1929, and issued to Hayde.

One of the primary objects of the instant invention is the provision of a method and apparatus for treating raw materials that results in a superior product; will yield a larger quantity of usable substance per ton of through-put; and that reduces production costs.

Hayde discloses how certain clays expand upon burning and how to take advantage of this characteristic when producing light weight aggregate. To accomplish this, Hayde's patent requires that raw material be subjected to burning and be heated to a high temperature at the beginning of the burning process. The material is progressively heated to a lower temperature as it passes through the kiln, and when it has cooled sufficiently, is crushed to produce relatively coarse particles. Hayde, however, did not reveal nor discuss the cause of expansion of clays due to the application of heat, as set forth in his patent. The manner of applying heat plays an important part in the method and apparatus contemplated by the present invention, and such method and apparatus is not revealed in Hayde's patent.

It has been found that clays contain magnesium and calcium carbonate, sulphur, iron and oxygen, and that expansion of the clay, brought about by the heat, is due primarily to gases formed from the combustion of the aforementioned elements, and particularly, iron and ferric oxide. Different clays contain various amounts of these elements and the process contemplated by this invention, must be conducted with regard to the heat applied. The time of treatment also is determined with reference to the proportions of the various constituents of the clay being used.

This invention relates further to the employment, in the manufacture of an aggregate, of the step of applying additional heat, by the impingement of a flame upon the material after the same has reached the expansive zone and has attained a temperature where the additional heat will cause the calcium oxide, magnesium oxide, ferric oxide, iron and other elements and compounds, to rapidly dissociate.

Under the process formerly used and described by Hayde and others, intense heat is applied to

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the material at the time it is introduced into the kiln. This heat tends to fuse the material and cause the formation of agglomerated masses thereof, as the same is rolled over-and-over in its transit through the kiln. These masses are frequently comparatively large in size and may be from one (1) to three (3) feet in diameter at the point of greatest cross section.

Because of the relatively great thickness of these masses, it is necessary that additional heat be absorbed to bring the material to the point at which it will expand and attain a vesicular form. Thus, the heat must penetrate to the center of the mass before it becomes effective to expand the material.

The necessity of bringing the entire mass to a temperature wherein expansion can take place, results in a number of deficiencies which is thought to be overcome by means of the instant invention. Under the old practice an incomplete expansion of the material takes place. This is undesirable since the product produced is of greater density and weight, which renders it relatively less fit for use in commercial applications. Further, where these masses occur, a comparatively low rate of through-put through the kiln is experienced because the masses must be brought to a temperature wherein the desired expansion will take place. The uneven heating of the material being treated requires that a large amount of heat be used in order to complete the operation, and this has made the process heretofore used a relatively expensive one.

This invention contemplates that the material treated be introduced into the kiln in the form of a cluster of relatively small particles. In practice it has been found possible to obtain this result by placing at the upper end of the kiln, a number of projections or lifts, approximately 24 in. to 36 in. long, spaced at appropriate intervals and secured against the inner face of the kiln. The actual dimensions of the projections and the interval of spacing are not critical and depend to a large extent, upon the type of material being treated and the temperature of the heat source employed. These projections engage the material as the kiln is rotated, and their construction is such that they break the material and carry it to a higher elevation within the kiln. At this higher elevation these projections dump the material and cause the same to drop downwardly in the form of small particles through the initial heat zone. This heat zone is preferably maintained by a flame disposed along the longitudinal axis of the kiln throughout a length thereof substantially equal to the portion occupied by the aforementioned projections. Thus, the material will descend through the flame and the cycle repeated until the material reaches a temperature slightly less than that required to precipitate expansion.

The material thus reaches the expanding zone at a relatively high temperature and is brought in contact with a flame or heat source, resulting in the expansion of the material. During the time of heating, it is only necessary that the heat used to produce expansion permeate a comparatively small mass of material.

In practice, it has been found desirable, in many instances, where a particular type of clay is used, to employ an intermediate flame or heat source between the initial heat source and the expanding zone. This intermediate source of heat serves to maintain the temperature of the clays at a desired heat during their passage through the comparatively long path of travel in the kiln.

Certain clays are more readily brought to the temperature desired in the first stage of the process, and to prevent over-burning these clays during the initial stage, while they are being prepared for dissociation in the expanding zone, it is desirable that the same be raised to the proper temperature and that this temperature be maintained by an auxiliary flame or flames as the material is passed through the length of the kiln.

Other types of clays require a more intense heating during the initial stage of the process and for this reason, the invention contemplates an intermediate unit which may be positioned to permit additional heating during the inception of the process or intermediate heating of the material as it passes through a kiln, as hereinbefore described.

Thus, it is clear that the process contemplates bringing the material to a temperature somewhat short of that required to produce expansion and that this is done by means of heating material as it is broken into relatively small parts to a temperature less than sufficient to produce expansion and the concurrent agglomeration, and then heating the material to a point where the same expands to a cellular formation. By this method, the capacity of the kiln is greatly increased—further, the quality of the material is improved, and less heat is required for treatment of a given volume of material.

In practice, it has been found desirable to heat the material to a temperature in excess of 1200° F., but less than 1800° F. in most instances. Since the materials used in this process vary greatly in their chemical constituents, it is impossible to specify the temperatures used in all cases, however, generally speaking, it will be found that the temperature of the initial heating zone should be in the range of 1200° F. to 1800° F. The temperature of the material at this time of its treatment in the second zone, or zone of expansion, is, generally speaking, in the range of 1500° F. to 2500° F. for most materials.

In the accompanying drawing is shown apparatus by means of which the process may be carried out, wherein:

Fig. 1 is a side elevational view of a kiln embodying the invention and suitable for performing the process.

Fig. 2 is a condensed longitudinal sectional view of the kiln showing the arrangement of parts in the interior thereof and the manner of disposing the burners to direct flames against material being treated.

Fig. 3 is a cross sectional view, taken on line III—III of Fig. 2, showing the primary heating section of the kiln having projections thereon. This figure further shows the disposition of the material within the kiln during the primary heating stage.

Fig. 4 is a cross sectional view of the kiln taken on line IV—IV of Fig. 2, showing the position of the flame from the initial burner and the disposition of material within the kiln at this point.

Fig. 5 is a cross sectional view of the kiln taken on line V—V showing the normal position of the flame from the intermediate burner and the disposition of the material being treated at this point in the kiln; and

Fig. 6 is a cross sectional view of the kiln taken on line VI—VI of Fig. 2, showing the position of the flame from a secondary burner and material being treated at this point in the kiln.

Kiln 8 has a number of projections 10, angular in cross section, to insure lifting of material 12 to an elevated point from whence the same is dispersed downwardly through a flame 14 on the longitudinal axis of kiln 8 and produced by means of primary burner 16.

Burner 16 is secured to conduit 18 extending to a source of fuel supply and carrying an intermediate burner 20. A universal coupling 22 permits directing flame 23 against the material at desired zones along the length of kiln 8 after the same has passed beyond a place where projections 10 no longer engage it. Positioned behind this intermediate burner 20, is a secondary burner 24, normally directed towards the lowermost portion 26 of kiln 8, where the material is tending to mass.

Kiln 8 is rotated by means of motor 30 and gearing 32, as shown in Fig. 1.

The adjustable burner 20 is attached to conduit 18 by the universal joint 22 in such fashion as to be projected in any direction to supplement flame from burner 16 or 24, and thereby obtain results as hereinbefore described.

Having thus described and explained my invention, what I claim as new and desire to be secured by Letters Patent is:

1. The process of treating argillaceous material to produce a lightweight aggregate for the purpose specified said material having the property of expansion due to formation of cells therein during application of a sintering heat which process consists in introducing the material in finely divided form into one end of a revolving kiln having a flame projecting thereinto from the opposite end thereof and on the longitudinal axis thereof; repeatedly raising and dropping the material in finely divided form through the flame after its entrance into the kiln to uniformly heat the material to a temperature slightly less than required to cause expansion thereof by formation of cells therein; and thereafter directing another flame of a higher temperature against the mass of material sufficient to expand the material whereby to avoid agglomeration of the material prior to application of said higher temperature and form small masses of material convertible by cellular expansion into a lightweight aggregate with a minimum of sintering heat input.

2. The process of treating argillaceous material to produce a lightweight aggregate for the purpose specified said material having the property of expansion due to formation of cells

therein during application of a sintering heat which process consists in introducing the material in finely divided form into one end of a revolving kiln disposed at an angle to cause the material to move toward the other end thereof; directing a flame longitudinally into the kiln on the axis thereof from said other end; repeatedly raising and dropping the finely divided material through the flame to uniformly heat the material being treated as it passes through a portion of the kiln to a temperature in excess of 1200° F. but slightly less than required to cause cellular expansion thereof due to formation of gases therein at a sintering temperature; and directing flames of a higher temperature against the material as it passes toward the said other end of the kiln in massed form from the said portion of the kiln sufficient to cause expansion thereof by formation of gas cells therein whereby to avoid agglomeration of the material prior to application of said higher temperature.

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