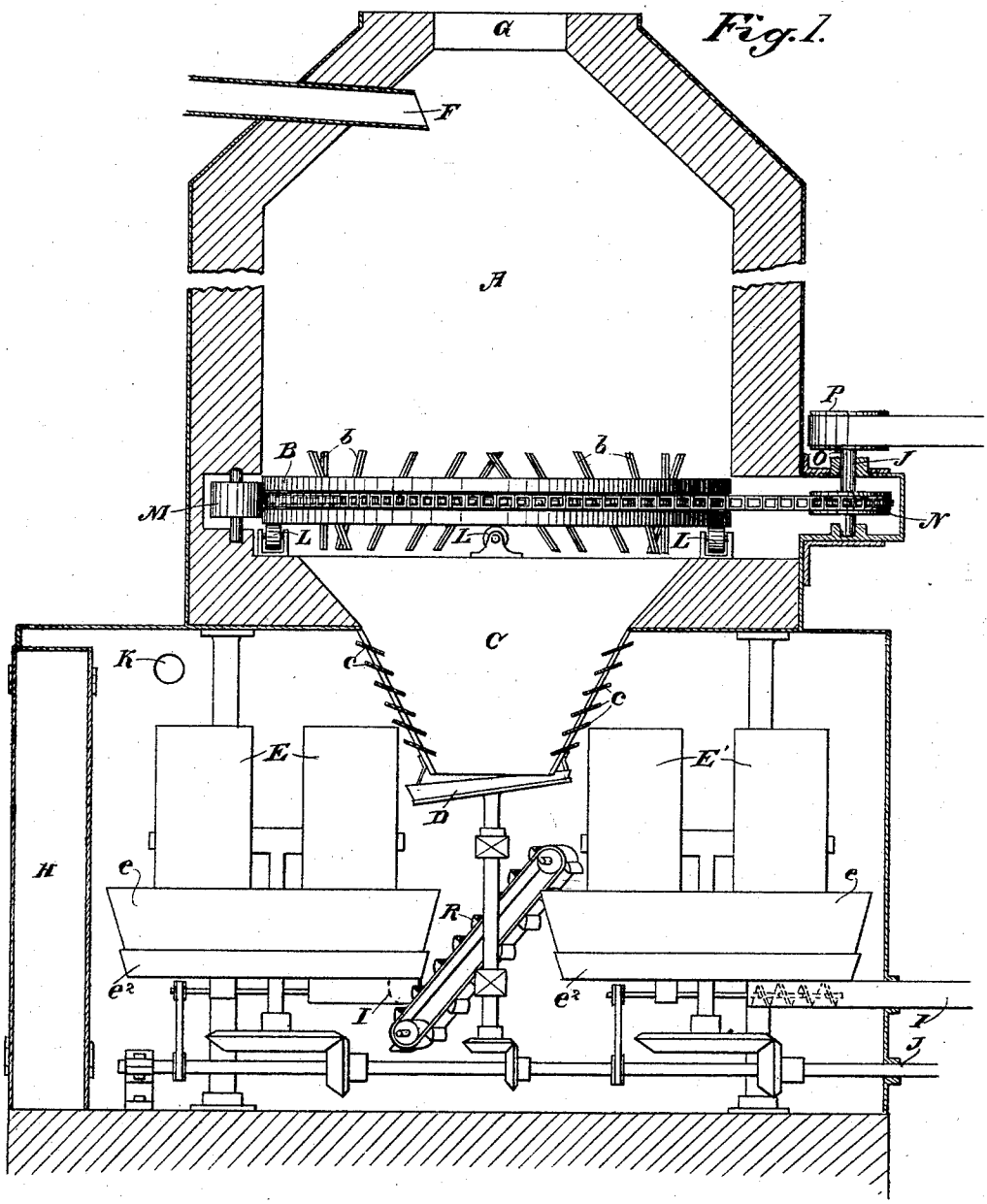
(No Model.) 2 Sheets—Sheet 1.

E. L. RANSOME.

MEANS FOR TREATING CITY REFUSE.

No. 524,688. Patented Aug. 14, 1894.

Fig. 1.



Witnesses,
J. Stowe
J. F. Ascheck

Inventor,
Ernest Leslie Ransome

(No Model.) 2 Sheets—Sheet 2.

E. L. RANSOME.

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Fig. 2.

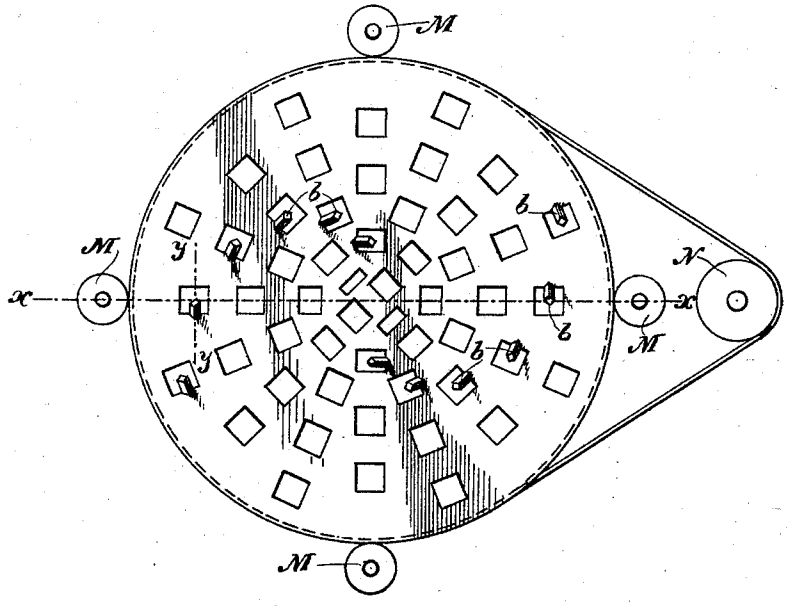


Fig. 3.

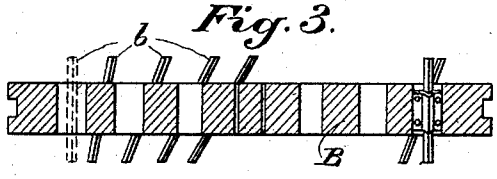
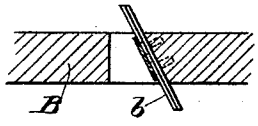


Fig. 4.



Witnesses,
J. Snure
G. F. Ascheck

Inventor,
Edward Leslie Ransome

UNITED STATES PATENT OFFICE.

ERNEST LESLIE RANSOME, OF OAKLAND, CALIFORNIA.

MEANS FOR TREATING CITY REFUSE.

SPECIFICATION forming part of Letters Patent No. 524,688, dated August 14, 1894.

Application filed January 2, 1894. Serial No. 495,441. (No model.)

To all whom it may concern:

Be it known that I, ERNEST LESLIE RANSOME, a citizen of the United States, residing in Oakland, county of Alameda, State of California, have invented an Improvement in Means for Treating City Refuse; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to means for utilizing cinders for which Letters Patent No. 322,559, of July 21, 1885, were granted me. In that patent the cinders are first burned and then crushed.

My improvement consists in breaking, regulating the fall of, and crushing the burned material automatically and contemporaneously with its removal from the furnace by means of the constructions and combinations of devices hereinafter described and claimed.

The accompanying drawings illustrate such invention.

Figure 1 is a vertical central section. Fig. 2 is a horizontal section taken above the breaker. Fig. 3 is a section on line *x x* Fig. 2. Fig. 4 is a section on line *y y* Fig. 2.

The essential object of this invention is the conversion of the waste matter of cities into a valuable aggregate for the manufacture of artificial stone, or concrete.

By the term "refuse" I include all such ordinary waste combustible matter as cinders, ashes, saw-dust, straw, leaves, and vegetable waste generally, animal waste, and street sweepings, all of which are of common occurrence in city refuse.

Under the name of "clinker" I include all the solid residuum of the burning of such refuse.

I have found it advantageous to burn the "refuse" in a furnace of the type known as "continuous." In furnaces of this class the fuel is continuously or continually fed to the furnace while the burned contents are constantly withdrawn. I have applied to this furnace an air-blast. By this I mean a thorough control of the air by means of a blast, therefore, in my invention air is driven through the contents of the furnace by a blast, or forced draft. I have also applied special construction and appliances for the automatic reduction and removal of the clinker, and this special construction is a part of my invention.

In burning "refuse" in a blast furnace of this description such enormous clinkers are sometimes formed in said furnace by such burning that all ordinary appliances are unable to cope with them. They are sometimes as large as nine feet in diameter and thirty or forty feet high. To remove such a "clinker" by hand is too expensive and too tedious to be practical. The object of burning this "refuse" is three-fold, viz:—to destroy it, to obtain heat therefrom, and to form a "clinker" that is suitable for the manufacture of artificial stone. To break such clinker in the furnace by automatic appliances and then remove the lumps without interfering with the blast of the furnace I have also found to be impracticable. I have therefore devised an automatic method whereby, while the operations of the furnace proceed in a continuous way without interruption, the "clinker" is first roughly broken from the mass and then conveyed to one or more grinding mills within the sphere or influence of the furnace air current, ground, and finally discharged in a granulated and powdered condition from the furnace through an air-lock, for although I know of no good way to create a continuous or continual air-lock for lumps of hard material, it is easy to arrange suitable air-locks for granulated and ground or ground material alone. The reduction cannot well be carried on beyond the influence of the air blast; because there is no known means practically available for conveying continuously the broken lumps out of the influence of the air blast without too great a waste of the air blast, whereas, after grinding, it is an easy matter to convey continuously the fine powder out of the influence of said blast by an air-lock without wasting the blast.

The foregoing process is accomplished by the aid of the following appliances, viz., a continuous furnace A, revolving breaker B, a chute C, regulating discharge feeder D, and mills E and E′.

The furnace A is usually cylindrical in plan, some ten feet in diameter, and eighty feet high above the breaker. Below the breaker it is made considerably larger in area so as

to give room for one or more mills E and E'. It has a fuel feed at F, an outlet for gases at G, an air-locked outlet for crushed clinker at I, an air-locked door at H, air-locked entrances for shafting at J, and a blast inlet at K.

The revolving breaker B supports the mass of burning and burned matter as shown. To it are attached adjustable breaking bars *b*. The breaker is in the form of a massive grate with apertures about six or eight inches square, the size of the openings being determined by the capacity of the mills E to crush the lumps that pass through them. They should not pass any larger than what the mill would crush. The breaker is supported upon rolls L and held in place to prevent side motion, by guide rolls M, and is driven by chain from sprocket N by means of power conveyed to the shaft O through sprocket or pulley P. The rolls and sprocket are air-locked within the furnace after the manner shown. The breaker may, however, be supported and driven by any other well known way. The breaking bars *b* are steel about two inches square and about two feet long to allow for wear. They are usually clamped to the flanges of the grate, as shown in Figs. 3 and 4, with their upper ends projecting several inches above the surrounding surface of the grate. In order that they may be self-sharpening, and the better able also to break off lumps of clinker, I set them at an inclination with the upper end forward toward the way the grate travels. These bars may be of any suitable size and shape, and they may be fastened to the grate in any convenient way, that will permit of ready adjustment to take up wear. In practice, I clamp them to the breaker, as shown in Figs. 3 and 4. I fasten these bars relatively to one another and to the grate so that in a revolution of the grate every portion of the lower surface of the clinker will be subjected to their influence. Fig. 2 illustrates this arrangement in which the relative position of the bars is shown.

The chute C is of iron or other suitable material placed at an incline of sixty degrees, or at such an angle as will cause the broken "clinker" falling upon it from the breaker B to readily roll or slide down on its surface to the regulating feed D. It may be built solid or by preference of open construction to admit of the free passage of air as shown at *c*.

The regulating feed D may be as shown, consisting of the well known revolving table set at an angle, at the lower portion of which is an opening in the chute to permit of the discharge of the "clinker," or it may be constructed after any of the well known ways. This feeder is generally a necessary adjunct to the chute, because usually the broken clinker, if unchecked, will fall too irregularly, and sometimes too fast through the grate, and to regulate this is a part of my invention.

In burning such a variable material as city waste, the resultant "clinker" is apt to inherit irregular characteristics. It may be at one time almost a solid clinker, at another time it may be mostly dust or small particles or pieces. If, therefore, permitted to pass through the grate unchecked, at one time it would fall through at the rate it was broken off by the breaking bars, and at another, owing to a change in the character of the descending clinker it would suddenly rush through the grate like gravel until all available space below had been filled, greatly to the detriment of the fire above and the mill below, and stopping all automatic operation. Between these two extreme cases there lies enough difference to render it necessary to prevent an unchecked passage through the grate. I prevent it as follows: I place at the bottom of the chute an adjustable automatic feed and so regulate the delivery that the chute chamber is kept filled or nearly so with loose clinker about up to the under side of the grate. This feed is adjusted to pass the average amount of material that passes through the grate. In operation, while the "clinker" is of normal quality, the supply of broken "clinker" to the chute chamber is about the same in quantity as that taken from the chute chamber by the feed. If a very hard and solid "clinker" comes on the grate then the supply to the chute chamber diminishes, and the amount in the chamber will be lessened, but this no sooner occurs than the small particles that generally are present in seams and pockets of the solid clinker, and between various large clinkers, and which hitherto had been retarded and kept back by the high level of the material in the chute chamber, are released and continue falling at higher speed until the normal level of the material in the chute chamber has again been reached. So, vice versa, when the fine particles or pieces predominate on the grate, they speedily fall until the chute chamber and the apertures in the grate becoming filled therewith then this fall is checked, and the normal condition is soon again reached. The grate revolves so slowly that being clogged by this material in its loose state is no serious objection.

From the discharge feed the clinker passes in regulated quantity into the grinding mill E from which it either passes direct in the crushed state through an air-locked passage I or it goes by elevator R through auxiliary mill E', and from thence through air-locked discharge passage I.

The advantage of two or more mills is simply in the economy of grinding. The mill I have adopted for this work and shown in my drawings, is the well known edge runner mill with perforated revolving pan *e* through which the crushed material passes, and is caught upon another lower and fixed pan e^2 from whence it is swept by blades placed upon the lower side of the upper pan into the

conveyer I or the elevator R. Any other suitable mill, however, I regard as the equivalent of this mill for the purpose of this invention.

The air-lock delivery I consists of a screw-conveyer of any of the usual patterns, and the air-lock in passage I is formed by the crushed material. The screw-conveyer receives the material from the mill and pushes it ahead into the tube, which continues beyond the screw and passes through the wall of the chamber. When the tube once becomes full, it remains so and thus locks the air off. Additional material only displaces sufficient material in the tube to make room for itself in a compacted condition. The displaced material falls out of the tube on the outside. In place of this conveyer and air-lock tube, any other suitable conveyer or air-lock (of both of which there are many well known kinds) may be substituted.

The operation is as follows:—Fuel is fed in at the top through air-lock delivery feed F continuously or continually, and the "clinker" or residuum after burning in due course rests upon the grate B and bars *b* by which the large lumps are broken up, and the clinker passes through the apertures of the breaker B which revolves continuously into the chute C, from which it passes in regulated quantities through the discharge feed D into the mill E where it is ground and from which it passes *via* mill E′ where it is ground yet finer, or else direct into air-lock conveyer I, through which it is delivered into the open air. Thus the operations of breaking, regulating the withdrawal of the clinker and grinding the same, are all carried on within the sphere of the air-blast and without interfering with the same.

I am aware that revolving grates with fixed teeth are not new, and that furnaces have been arranged with water locks to the ash pits. Neither of these do I claim in this invention, for the former are entirely inadequate for the performance of breaking massive clinkers such as are made in my furnace. No matter how large they may be made, they soon wear down and become useless, and the latter is inadmissible for I require the material dry.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of a furnace, an air-locked chamber communicating therewith, means for forcing air into said chamber, and clinker reducing devices located within the furnace and within the air-locked chamber.

2. The combination, of a furnace, an air-locked chamber communicating therewith, means for forcing air into said chamber, clinker reducing devices located within the furnace and within the air-locked chamber, and an air-locked outlet for the reduced material.

3. An apparatus for reducing "clinker" produced by burning, consisting of a furnace in which the material is burned, a breaker forming a grate for the furnace situated at the lower part upon which the "clinker" formed by said burning descends, devices upon which the breaker is supported and guided, adjustable breaking bars fixed in openings made through the breaker and projecting upward so as to form contact with the lower surface of the mass of "clinker" as it descends, and a driving chain and sprocket wheels through which power is transmitted to rotate the breaker.

In witness whereof I have hereunto set my hand.

ERNEST LESLIE RANSOME.

Witnesses:
S. H. NOURSE,
H. F. ASCHECK.