Nov. 28, 1933. M. M. UPSON 1,936,810

METHOD OF TREATING REFUSE AND MAKING BUILDING MATERIAL THEREFROM

Filed Aug. 19, 1930 5 Sheets-Sheet 1

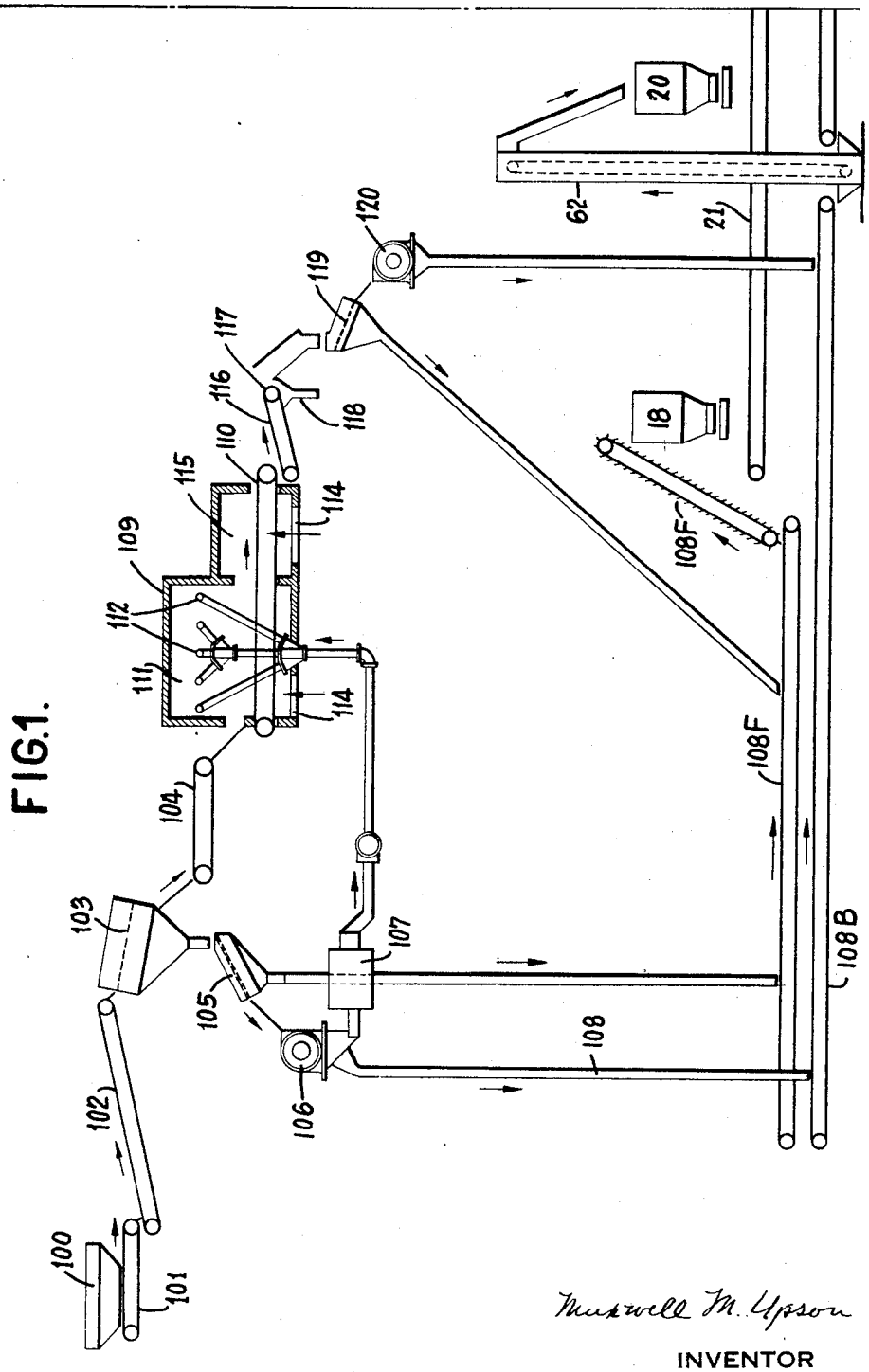


FIG.1.

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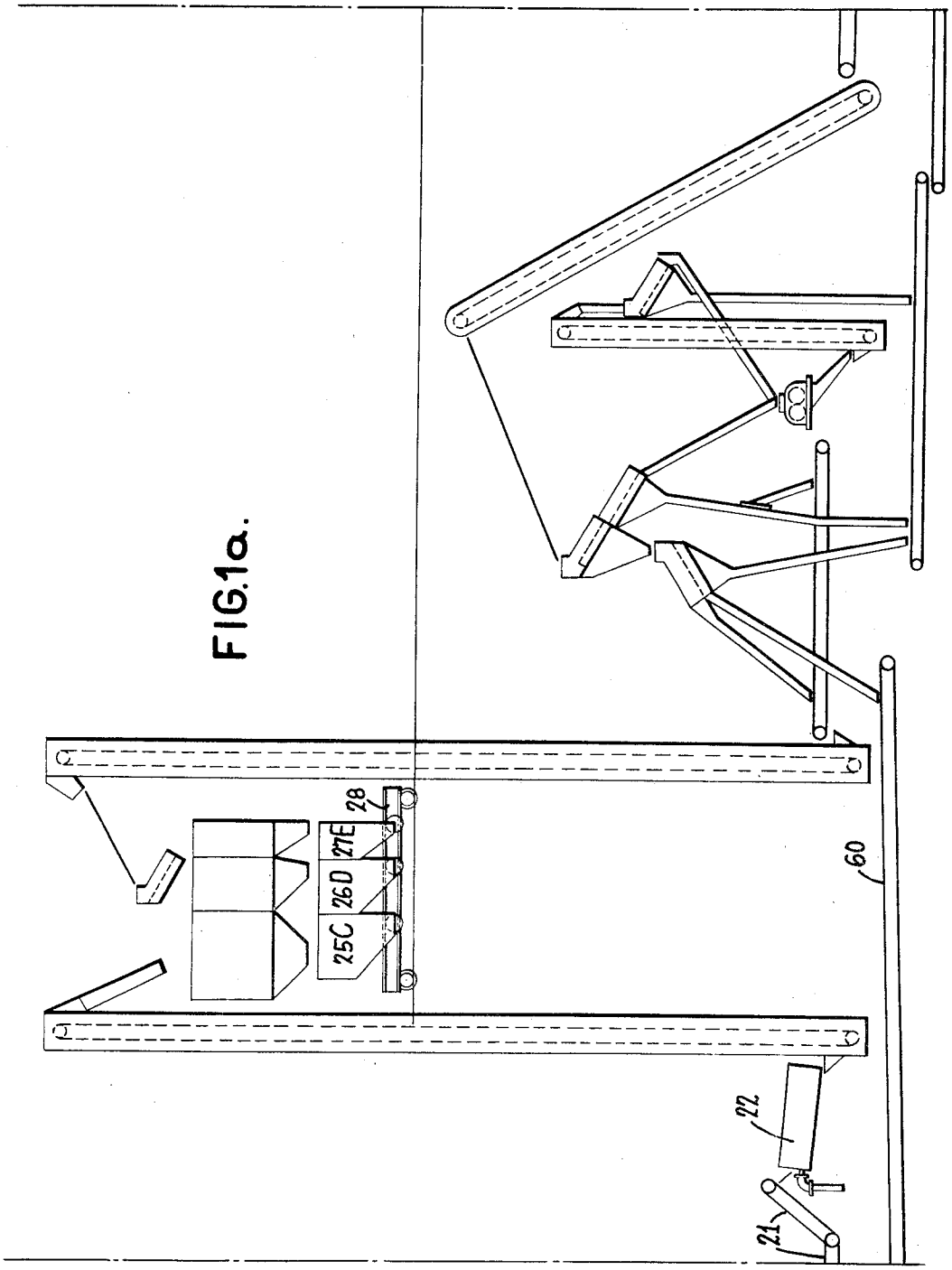
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METHOD OF TREATING REFUSE AND MAKING BUILDING MATERIAL THEREFROM

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FIG. 1a.



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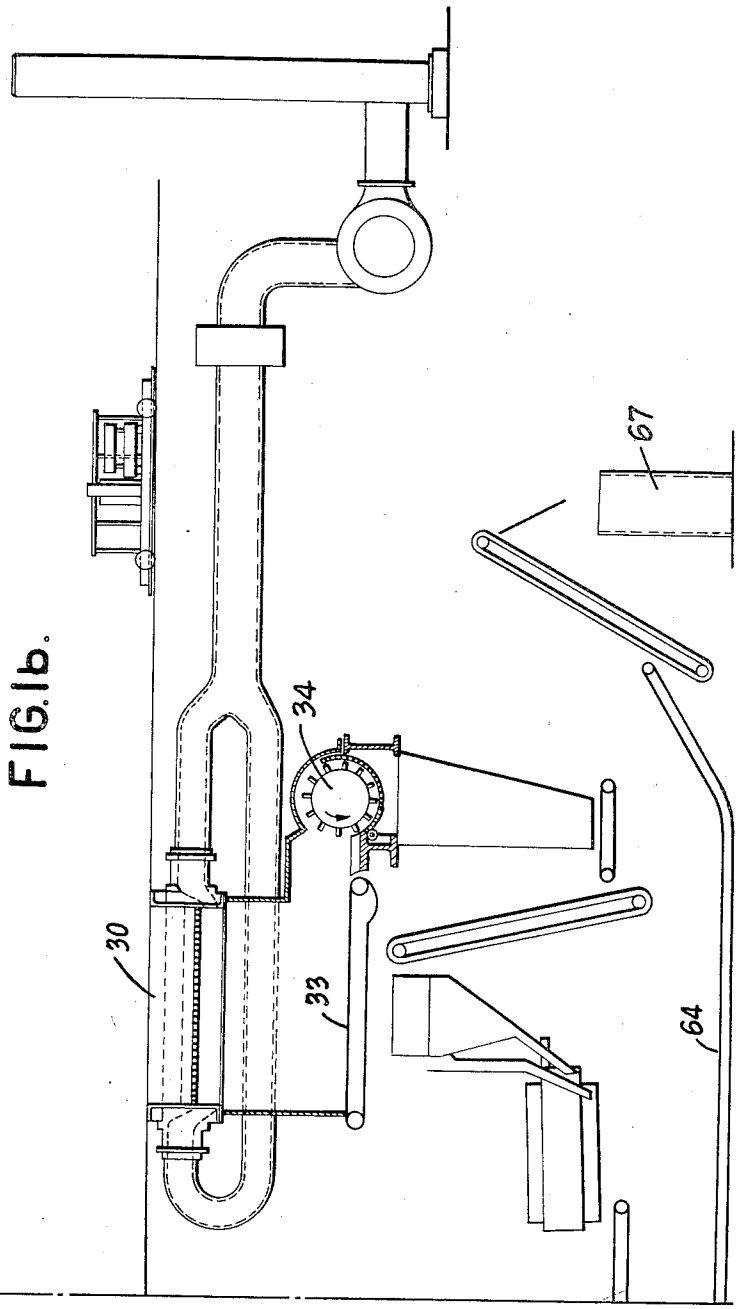
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METHOD OF TREATING REFUSE AND MAKING BUILDING MATERIAL THEREFROM

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FIG. 1b.



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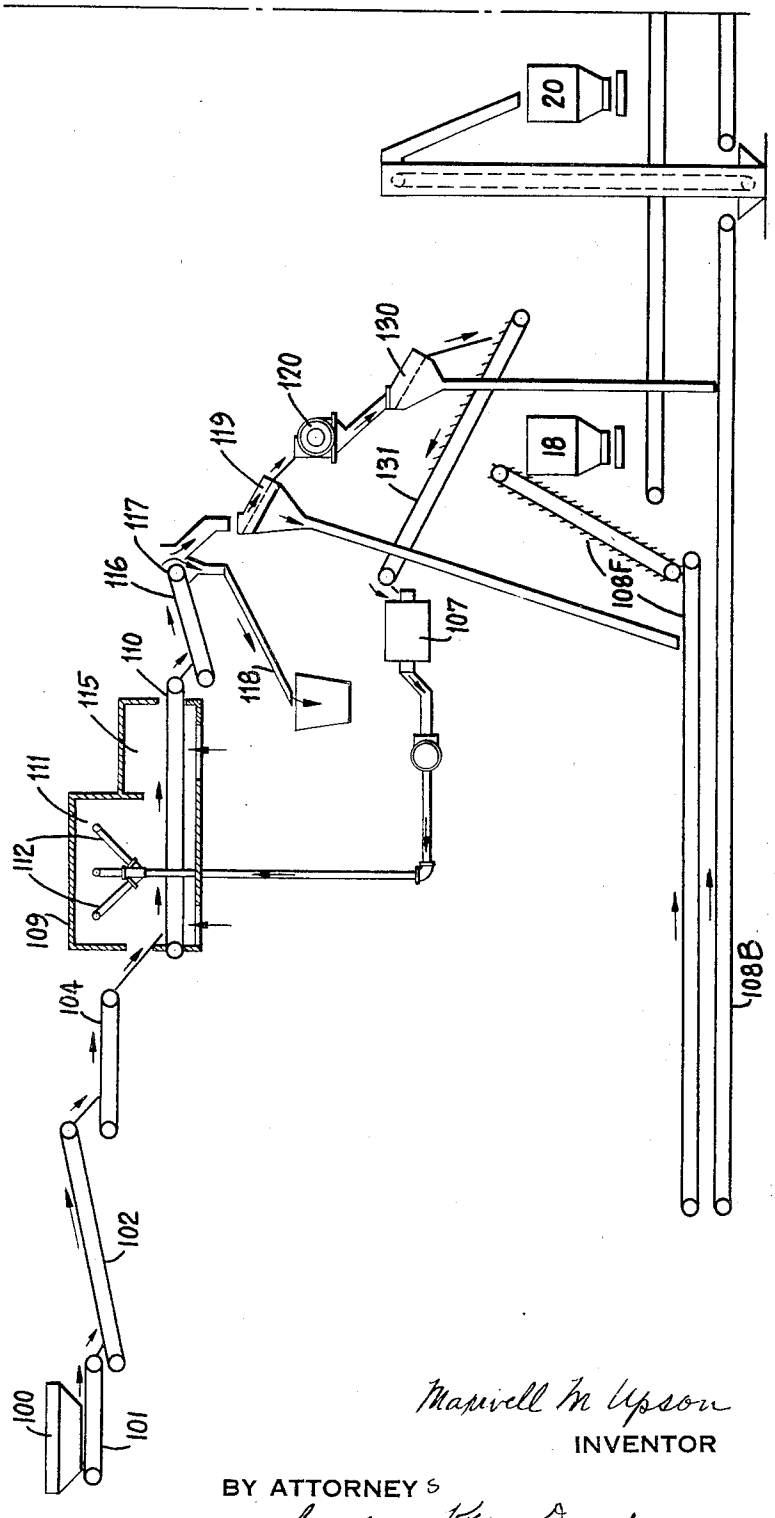
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METHOD OF TREATING REFUSE AND MAKING BUILDING MATERIAL THEREFROM

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FIG. 2.



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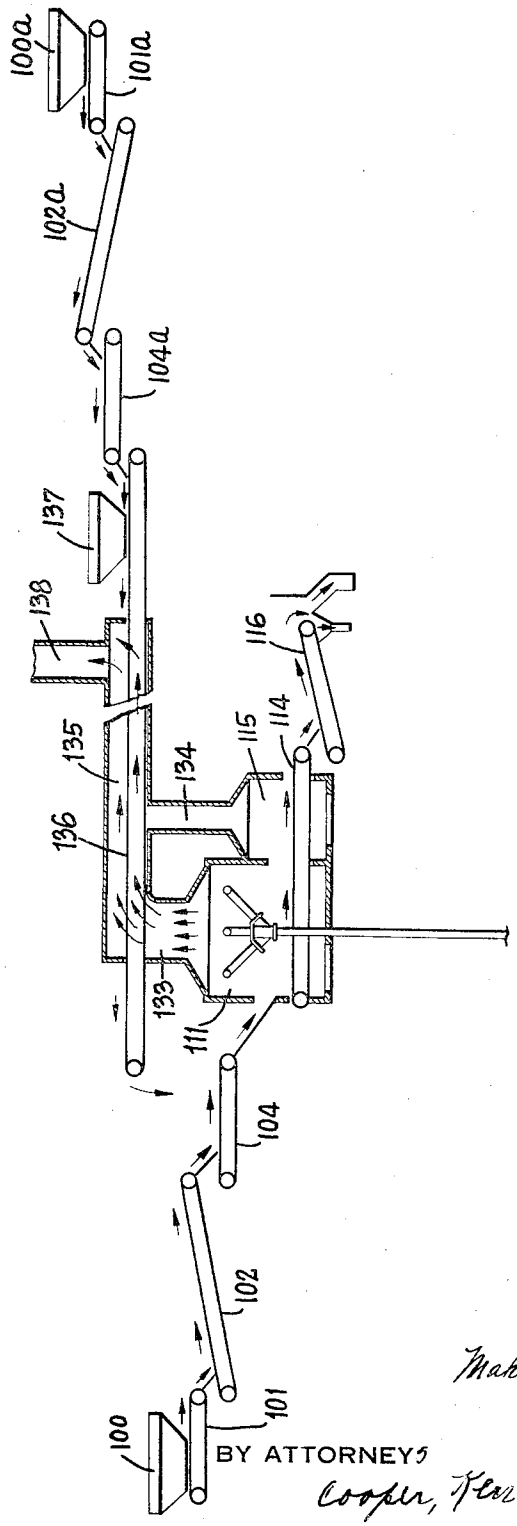
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METHOD OF TREATING REFUSE AND MAKING BUILDING MATERIAL THEREFROM

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FIG. 3.



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UNITED STATES PATENT OFFICE

1,936,810

METHOD OF TREATING REFUSE AND MAKING BUILDING MATERIAL THEREFROM

Maxwell M. Upson, Englewood, N. J.

Application August 19, 1930. Serial No. 476,322

8 Claims. (Cl. 106—24)

At the present time processes and methods are in use wherein ash refuse is converted into a concrete aggregate. A method and apparatus for making such aggregate from refuse is set forth in the application of Edward B. Corbet, Serial No. 426,290, filed February 6, 1930, to which reference may be made for a fuller description of the process of making aggregates from refuse by a sintering operation.

In brief the process comprises the sintering of the ash refuse to burn out the combustible and to consolidate the non-combustible constituents by sintering into the desired aggregate.

In carrying out the foregoing aggregate making process, conditions sometimes arise where the primary ingredients, that is the coal ash refuse, as received by the plant, comprise a considerable content of refuse which is of a bulky nature. Such bulky refuse may comprise paper cartons, boxes, barrels, bottles, lumber and other foreign material. Such material is so bulky in its nature that it does not readily lend itself to sintering treatment in the aggregate making plant above mentioned. Some of such bulky refuse may be combustible, other parts may burn with difficulty or be wet and other materials may be of non-combustible nature but which may be reduced in bulk by the application of high temperatures. Accordingly, it has heretofore been the practice to remove these bulky constituents from the coal ash refuse and to separately dispose of them and to only utilize ash refuse itself in the process of making aggregates.

In other cases, large quantities of garbage require disposal and heretofore such garbage disposal has been carried out separately from the process of making aggregates.

In the process of making aggregates from coal ash refuse, it has been the practice heretofore after separating out and separately disposing of the bulky refuse materials, to screen out the fine ash particles from the coarse ash particles and to thereafter crush the coarse ash particles and subsequently recombine these crushed ash particles with the fine ash particles and subject the mixture to the sintering operation. In practice it has been found that the combustible content in the coal ash refuse is found principally in the coarse ash particles and the reason for crushing the coarse ash particles separately is to render available the contained combustible. Then by the recombining step this contained combustible is more uniformly disseminated in the fine ash and other non-combustible particles which are to be sintered.

In the practice of making aggregates from ordinary ash refuse, it has been found that the coarse ash particles usually contain more combustible than is needed for the sintering process and for the making of the aggregate. Accordingly, heretofore this excess combustible is merely burned up and accordingly the heat of combustion of such combustible is in part wasted.

According to the present invention, provision is made for utilizing a part of the combustible content of the ash refuse or of the incinerator ash produced by the process for the preliminary treatment of the bulky constituents above mentioned or of garbage so that these bulky constituents or garbage may be burned and consumed in whole or in part and so that the bulk of the material may be reduced so that subsequently the ash refuse from the bulky constituents or from the garbage (which material will hereinafter be termed "incinerator ash") may be utilized with the other ash refuse in the making of the aggregate by sintering operations. In this way the expense of separate disposal of the bulky constituents in the aggregate making plant is obviated and all of the received crude refuse materials with the exception of objectionable tramp iron, may be utilized in the making of the aggregate.

The present invention has for one of its objects the provision of novel methods for treating refuse including rubbish of various sorts to the general end that substantially all of the refuse may be utilized in the making of other aggregates and light weight building material.

A further object of the present invention resides in the provision of a new method of treating refuse to prepare the same for subsequent sintering operations in which the refuse is converted by sintering and other steps into a desired aggregate or light weight building material.

A further object of the present invention resides in the provision of a method of incinerating refuse in which incineration is carried out by action of a pulverized fuel flame and in which the combustible for such flame is derived from the refuse material either before or after incineration.

A further object of the present invention resides in the provision of a novel method for the incineration of refuse.

A further object of the present invention resides in the provision of novel methods of making concrete aggregates.

Further and other objects of the present invention will be hereinafter set forth in the accom-

panying specification and claims and shown in the drawings which show somewhat diagrammatically certain preferred embodiments of apparatus adapted for use in carrying out the methods which form the subject matter of the present invention.

In the drawings:

Figures 1, 1*a* and 1*b* taken together show somewhat diagrammatically various units of the apparatus which are adapted for use in carrying out the method. On Figs. 1*a* and 1*b* the showing is made of certain parts of the apparatus which are used in the method of making aggregates by sintering operations;

Fig. 2 is a view of a modified construction and the apparatus shown in this sheet is to be utilized in lieu of the apparatus shown in Fig. 1; and

Fig. 3 shows a view of another modification of certain parts of the apparatus.

According to the method of making aggregates set forth in the aforesaid Corbet application, it was the practice to separate out the fine ash particles from the coarse ash particles and to subsequently crush the coarse ash. In the foregoing specification such materials were termed as "fine ash A" and "crushed ash B" and it was the practice to store these materials in two separate bins. In Figs. 1 and 2, 18 is the bin for the fine ash A and 20 is the bin for the crushed ash B. A full description of the subsequent treatment of these materials will not be herein repeated but in brief it may be stated that the materials are mixed on a conveyor belt 21, discharged by it into a mixer 22 and thence carried up to a compartment 25C of a charge car generally designated 28. The charge car also contains other compartments 26D for single burned material D and 27E for bedding material E. In the previous method these various materials were delivered into the sintering pan generally designated 30 in Fig. 1*b* and after being subjected to the sintering operation in that pan they were dumped on to a conveyor 33 which delivered the materials to a hot crusher generally designated 34. After being crushed by the hot crusher the materials were subjected to further crushing and classifying steps, the final aggregate product ultimately being discharged upon a conveyor 64 and delivered to storage at 67. Certain of the materials which were classified out by the classifying steps were delivered back via belt 60 and returned to the elevator 62 which discharged the materials into the "crushed ash B" bin 20.

According to the present invention the preliminary steps of treating the refuse are modified in particulars which will hereinafter be set forth and it will be understood that from bins 18 and 20 on the steps of the method are the same as fully set forth in the Corbet application above mentioned and which have been briefly described in the preceding paragraph.

Referring to Figs. 1, 1*a* and 1*b*, the crude refuse containing ashes and bulky rubbish is fed from a suitable hopper 100 and delivered by a feeder 101 to a picker belt 102. As the picker belt advances, salable and re-claimable particles are taken from the ash and rubbish. This operation may be carried out by hand. From the picker belt 102 the rubbish and ash which have been left upon the picker belt are fed into a screening device 103. Such screening device 103 may be of the revolving type or of the shaker type as desired. The screen 103 separates the received material into the bulky refuse which passes over the screen and which is delivered to a spreader belt 104 and into the ash refuse which passes through the screen and which is fed on to a second screen 105. This second screen 105 separates the fine ash particles from the coarse ash particles, the latter particles as before explained containing the unburned or partially burned coal. The fine ash particles pass through the screen 105 and by suitable conveyors 108F are carried to the fine ash supply bin 18 of the aggregate making plant. The coarse ash particles including a considerable amount of the unburned and partially burned coal pass over the screen 105 and are delivered to a crusher 106 in which they are reduced to a fine state.

From the crusher 106 the crushed material containing combustible can be fed to a fine crusher 107 for the production of pulverized fuel and if desired a part of the production of the crusher 106 can be diverted via 108 to the aggregate making plant, there being delivered to the bin 20 which contains the crushed ash B material. In the drawings, 108B indicates diagrammatically the conveyor which delivers diverted crushed material and other material as will be subsequently explained, to bin 20 of the aggregate making plant.

Returning now to the bulky refuse which has passed over screen 103. As before stated, this material is delivered to a spreader feeding belt 104 which in turn feeds the bulky rubbish into the incinerator generally designated 109. This incinerator is of novel construction having a travelling grate 110 which carries the rubbish through two combustion chambers having two different temperature zones. Combustion chamber 111 is the high temperature zone and the heat in this combustion chamber is produced by a pulverized fuel burner installation with pulverized fuel burners generally designated 112 and receiving the pulverized fuel from the fine grinder 107. As stated before the unburned coal is found in the crushed coarse ash which material is in part delivered to the fine grinder 107.

In chamber 111, in the high temperature zone, the heat of combustion resulting from the burning of the pulverized fuel is high enough to dry out the moisture in the rubbish, char it and ignite it. Preferably air to support combustion is supplied to the incinerator 109 in a pre-heated or superheated condition in order to hasten the process of drying and igniting the rubbish. 114 diagrammatically indicates such pre-heated air supply. Leaving the high temperature combustion chamber 111 the rubbish now thoroughly dry and partially burned or burning, passes into a second combustion chamber 115 wherein combustion proceeds at a lower temperature. In such chamber the refuse is consumed by its own combustible content and pre-heated air is supplied as before as indicated by 114.

The incinerator ash or burned refuse which is left after the burning of the refuse in the incinerator 109 is delivered to belt 116 provided with a magnetic separator 117 adapted to remove the tramp iron and dispose of the iron waste via 118. The incinerator ash after being separated from the tramp iron is then delivered to a screen 119. The fine incinerator ash refuse which passes through the screen 19 is delivered by conveyors 108F to the bin 18 of the aggregate making plant which bin contains the fine ash particles A. The coarse material which passes over screen 119 is delivered to a crusher 120. This crusher in turn delivers this material to conveyor 108B which delivers the material to bin 20 of the aggregate making plant which bin contains crushed ash B.

In Fig. 2, a modified embodiment is shown.

Here ash hopper 100, feeder 101, picking belt 102, are provided as before. In lieu of delivering the ash and rubbish material from the picking belt 102 on to screen 103, the picking belt 102 delivers all of the material without previous classification directly to the spreader belt 104 which in turn delivers it into the incinerator 109 which is of the construction previously described, having two combustion chambers 111, 115, the first for high temperature combustion which is produced by pulverized fuel burner devices 112 and the second chamber 115 for lower temperature combustion. Travelling grate 110 is provided as before to carry the rubbish through the incinerator. After leaving the incinerator, the burned incinerator ash refuse is delivered to belt 116 provided with a magnetic separator 117 to separate out tramp iron and iron waste at 118. From 117 the incinerator ash is delivered to a screen 119. The fine ash particles pass through this screen and are delivered via conveyor 108F to the bin 18 of the aggregate making plant, said bin containing fine ash A. The oversized incinerator ash passes over screen 119 and is delivered to a crusher 120. Such oversize incinerator ash refuse contains a considerable content of unburned coal or other combustible and from such crusher 120 the crushed material may be delivered directly to a fine grinder 107 which provides pulverized fuel for the pulverized fuel burner installation and for the pulverized fuel burners 112.

If desired, in lieu of delivering the crushed material directly from the crusher 120 to the fine grinder 107, the material crushed by the crusher 120 may be delivered to a screen 130. The fines which pass through the screen 130 may be delivered via conveyor 108B to bin 20 which contains the fine ash particles. The oversize material passing over screen 130 which contains most of the combustible may be delivered by a suitable conveyor 131 to the fine grinder 107 and after being finely ground will be burned by the pulverized fuel burner 112.

In cases where garbage refuse is available or where other refuse is at hand which requires predrying or delivery before it is delivered into the incinerator, preferably the arrangement shown in Fig. 3, is employed. According to this arrangement the ash refuse is delivered as before from a hopper 100 to belt 101, thence to picking belt 102, to spreader belt 104 and thence into the incinerator and on to travelling grate 114. The arrangement of the incinerator is the same as heretofore described except that vent stacks are provided as indicated at 133 and 134 from the combustion chambers 111 and 115. Such vent stacks 133 and 134 deliver the hot gases of combustion into a drying chamber 135 through which extends a conveyor belt 136. Garbage or relatively wet refuse is delivered on to the belt 136 from a hopper 137 and as such garbage or other material is carried by the belt through the chamber 135 the garbage or other wet refuse is thoroughly dried out and dehydrated by the heat of hot gases which flow through the chamber 135 in a direction counter to the direction of travel of the garbage therethrough as indicated by the arrows. The hot gases leave chamber 135 at stack 138. The garbage after being thoroughly dried out on belt 136 is carried out of the drying chamber and delivered to the spreading belt 104 where the garbage is intermixed with the ash refuse and carried into the incinerator chamber for subsequent combustion and treatment therein. After leaving the incinerator 109 the refuse is delivered by belt 114 to the magnetic separator belt 116 after which the steps are repeated as before described in connection with the description in Fig. 2. Obviously the fuel for the pulverized fuel flame can also be recovered from the ash refuse prior to its introduction in the incinerator according to the disclosure of Fig. 1.

In lieu of utilizing the arrangement shown in Fig. 3, for garbage, it will be understood that the usual ash rubbish and refuse can be submitted to the drying treatment in chamber 135 by the heat of the waste gases emerging from the incinerator. In such case the refuse would be delivered from hopper 100*a* to feeder belt 101*a* thence to picker belt 102*a* to spreader belt 104*a* which in turn would deliver the refuse to the belt 136 which passes through drying chamber 135. Also it will be appreciated that both garbage and ash refuse can be delivered to the belt 136 and carried through the drying chamber 135 in case this is desired. In such case garbage would be delivered from hopper 137 and ash refuse and rubbish would be delivered from hopper 100*a* as before described.

Whichever of the various methods above described is utilized includes the step of recovering combustible material from ash refuse by classifying and crushing operations. Such recovered solid combustible is utilized for producing the pulverized fuel flame which is introduced into the incinerator. According to the arrangement of Fig. 1, the combustible for the pulverized fuel flame is secured from the ash refuse before the bulky constituents are introduced in the incinerator. By this specific process the bulk of the material passing through the incinerator is reduced inasmuch as the coarse ash particles and fine ash do not pass through the incinerator.

According to the process of Fig. 2, all refuse passes through the incinerator and the combustible as before is recovered from the coarser particles of the ash refuse which entered as ash and also from the materials which were reduced in bulk by the incinerating step. As before the combustible for the pulverized fuel flame is derived from the refuse material by crushing and classifying operations.

According to the embodiment shown in Fig. 3, the combustible for the pulverized fuel flame may be recovered either before or after the incinerating step and in addition a preliminary drying out step is provided for.

Certain features of the present invention form the subject matter of my copending divisional application, Serial No. 668,786, filed May 1, 1933.

I claim:

1. The method of making aggregates from refuse which comprises the steps of recovering combustible from the relatively larger ash particles of the ash refuse, and in utilizing such recovered combustible from the relatively larger ash particles for the incineration of the bulky constituents of the refuse to reduce the bulk thereof and to convert the refuse into a state which is suitable for sintering and in subsequently sintering such incinerated material and converting it into the desired aggregate.

2. The process of making a light weight building material such as an aggregate from refuse in which a sintering step is employed for consolidating the unfused particles of refuse which includes the step of deriving combustible material from the large ash particles of the refuse

by separating out such large ash particles from the other refuse material and in utilizing the combustible so derived in the form of a pulverized fuel flame for incinerating the refuse prior to sintering.

3. The method of making aggregates including the steps of sintering ash refuse material to form the aggregate and including in combination therewith the steps of incinerating the material prior to sintering to convert the bulky constituents into a state in which sintering operations thereon may be effected and effecting such incineration by combustible derived from the larger ash particles of the ash material.

4. The method of manufacture of an aggregate from refuse waste materials containing coal ash refuse and other rubbish which other rubbish is in a state which is unsuitable for sintering which comprises incinerating the materials which are in a state which is unsuitable for sintering by combustible previously recovered from the larger ash particles of the refuse, then recombining the coal ash refuse with the previously obtained incinerated product and in thereafter sintering both of said materials for the purpose described.

5. In the process of making an aggregate which includes the sintering of refuse material to consolidate the non-combustible constituents of the refuse by the fusion resulting from sintering which includes the step of preparing the material for proper sintering by reducing the bulk of the refuse and rubbish by a preliminary incinerating operation so that all of the refuse is converted into a condition in which it is susceptible to a sintering treatment, and in effecting such preliminary incineration by combustible derived from the relatively larger sized ash particles which contain substantial portions of combustible.

6. The invention set forth in claim 5 wherein the incineration of the refuse is effected by a pulverized fuel flame and wherein fuel for such flame is recovered and provided from the larger sized ash particles of the refuse by a classifying and crushing operation.

7. The invention set forth in claim 5 wherein the incineration of the refuse is effected by incineration and wherein fuel for such incineration is recovered and provided from the larger sized particles of the ash by a classifying and crushing operation.

8. The process of making a light weight building material such as an aggregate from refuse in which a sintering step is employed for consolidating the unfused particles of refuse into an aggregate, which also comprises the preliminary steps of separating out from the crude refuse as received the bulky constituents, the fine ash material and the coarse ash particles and in thereafter utilizing the combustion of the coarse ash particles for incinerating the bulky refuse material and converting it into a suitable form for sintering, and in thereafter recombining the incinerated material with the fine ash particles and subjecting the same to a sintering operation to produce the desired light weight aggregate.

MAXWELL M. UPSON.