July 22, 1947. E. E. ROBERTSON 2,424,330

FURNACE

Filed Feb. 1, 1946

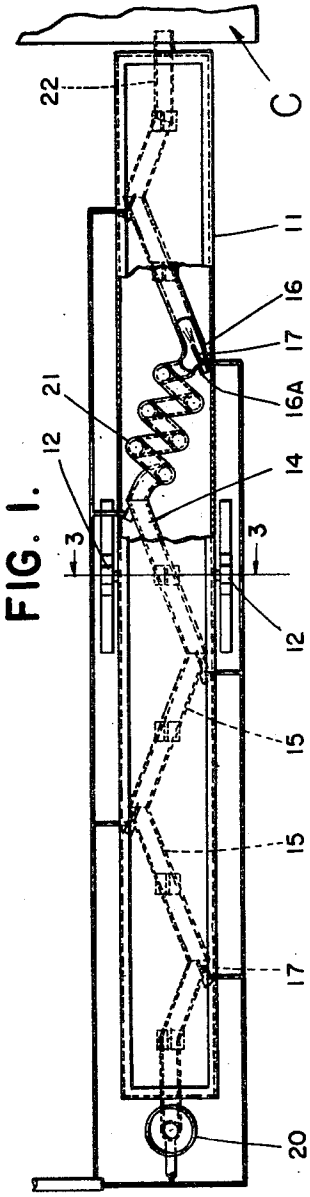


FIG. 1.

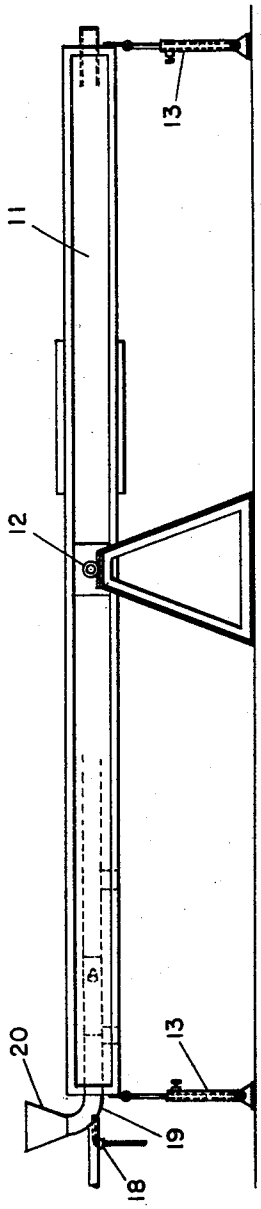


FIG. 2.

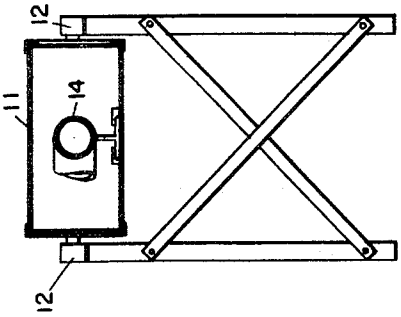


FIG. 3.

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Patented July 22, 1947 2,424,330

UNITED STATES PATENT OFFICE

2,424,330

FURNACE

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Application February 1, 1946, Serial No. 644,837

6 Claims. (Cl. 263—21)

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This invention relates to a furnace for expanding mineral materials such as perlite, vermiculite, and the like.

One object of my invention is to provide a furnace in which puffing minerals such as perlite and vermiculite may be expanded by heat. Another object is to provide a furnace apparatus in which particles of puffing minerals may be repeatedly subjected to the heat of a flame while suspended in a gas medium. Still another object is to provide means for continuously puffing perlite, vermiculite, and the like.

My invention will be understood from the following description, reference being made to the accompanying drawings in which:

Fig. 1 is a top plan view of my furnace structure;

Fig. 2 is a side elevational view of the same; and

Fig. 3 is a cross-sectional view taken on the line 3—3 of Fig. 1.

Referring to the drawings, a rectangular elongated box structure forms the casing 11 for my furnace, this casing being pivotally mounted on trunnions 12 disposed intermediate the ends of the furnace and having adjustable end supporting members 13 arranged so that the general slope of the furnace may be adjusted as desired. The heating chamber consists of a tubular conduit 14 which is arranged in a horizontal zig-zag path from one end of the furnace to the other by the joining of cylindrical pipe segments 15 whose ends 16 are joined so that adjacent segments are at angles of from 120° to 140°, with provision for the incorporation of gas burners 17 at the bends, the burners being directed near the center of the conduit and in the direction of the successive segments. A front gas burner 18 is provided in the furnace entrance end 19. Granular mineral material such as perlite or vermiculite is fed into the vertically arranged funnel 20 which directs the granular material in front of the burner 18 where the gases from the burner disperse the mineral particles, at the same time heating them and carrying the material forward to the first segment of the tubular conduit, at which point another burner 17 is directed into the next segment, where the gases added by the burner cause further dispersion and heating of the granular materials. This is repeated at the several elbows 16A in the conduit 14, as many of the segments and gas burners being provided as required by the nature of the material to be heated and expanded.

In some cases, it is desirable to produce additional spiral turbulence and segregation of the suspended partly expanded mineral in the gases,

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and to slow up the velocity of advance, which may be accomplished by introducing a helical section 21 in place of one or more of the straight segments 15. As shown, three complete helical loops in the conduit are provided but this number may be increased or decreased as desired to give the required effect. The heavier incompletely expanded particles are segregated from the completely expanded material by this centrifugal action so that they may be acted upon by the subsequent heating of later burners. The expanded or exploded mineral material such as perlite is collected at the exit end 22 of the conduit by the use of any convenient form of collecting apparatus C such as cyclone collectors, baffled chambers, etc.

The mineral perlite is peculiar in its response to heating in that when it reaches a certain critical temperature in the neighborhood of 1600° to 1700° F., it suddenly expands to many times its original volume. Only that portion of the mineral particle is thus expanded which has reached the critical temperature. This critical temperature varies somewhat for material from one source of mineral to another since perlite is not a mineral of definite composition. The portion of the mineral particle which when heated does not attain its critical temperature for expanding remains as a hard granule, and a mixture of highly expanded very light material along with heavy particles of unexpanded material is undesirable in the use of the material. This difficulty in expanding the material has been overcome by the use of my furnace which subjects the particles to the flames of gas burners arranged at positions in the elbows to most effectively subject the gas-carried particles to further heating so that if a particle is not completely expanded in the first stage, it has a good opportunity of being again heated to the critical temperature at subsequent burner positions.

The conduit 14 is preferably made of suitable metal in the form of smooth surfaced pipe to which the mineral does not adhere such as stainless steel or glazed high temperature porcelain. I have found that if the conduit is of granular rough structure such as of fire brick or the like, that the expanded perlite tends to adhere and build up in the interior of the furnace and prevents the further use, without frequently shutting down to clean out obstructions. The furnace conduit may be suitably insulated inside the case 11 either by dead air space or by the use of standard insulating refractory materials placed around the tubes.

In order to control the flow of gases and ma-

terial through the furnace tube, I find it desirable to be able to adjust the inclination of the furnace from the horizontal position shown in the drawings, and for this purpose have mounted the case 11 on the trunnions 12 and provided adjustable end supporting means so that either end of the furnace may be raised or lowered to attain the desired effect.

I claim:

1. In a furnace for heating a granular material held in suspension in combustion gases, a substantially horizontally disposed zigzag tubular conduit adapted to carry a stream of heated gases with suspended mineral particles from a feed end to a delivery end; and burner means directed into said conduit at two or more of the angles thereof.

2. In a furnace for heating a granular material held in suspension in combustion gases, a substantially horizontally disposed zigzag conduit comprising segments of tubing joined together at their ends at obtuse angular positions, adapted to carry a stream of heated gases with suspended mineral particles from a feed end to a delivery end; burner means directed into successive segments of said conduit at their entrance ends for said stream of gas; and means for introducing granular material into the feed end of said furnace.

3. In a furnace for heating an intumescing granular material held in suspension in combustion gases, a substantially horizontally disposed zigzag tubular conduit comprising segments of tubing joined together at their ends at obtuse angular positions, adapted to carry a stream of heated gases with suspended mineral particles from a feed end to a delivery end; burner means directed into successive segments of said conduit at their entrance ends for said stream of gas; means for introducing granular material into the feed end of said furnace; and means in a later segment of the conduit to segregate unexpanded and heavy particles of mineral from the fully intumesced particles.

4. In a furnace for heating an intumescing granular material held in suspension in combustion gases, a substantially horizontally disposed zigzag tubular conduit adapted to carry a stream of heated gases with suspended mineral particles from a feed end to a delivery end; burner means directed into said conduit at the angles thereof; means for feeding the granular material into the feed end of said furnace; means in a later portion of the conduit to segregate unexpanded and heavy particles of mineral from the fully intumesced particles; and means to vary the general slope of said furnace.

5. In a furnace for heating an intumescing granular material held in suspension in combustion gases, a substantially horizontally disposed zigzag tubular conduit comprising segments of tubing joined together at their ends at obtuse angles, adapted to carry a stream of heated gases with suspended mineral particles from a feed end to a delivery end; burner means directed into said conduit at two or more of the angles thereof; and means in a later portion of the conduit adapted to segregate unexpanded and heavy particles of mineral from the fully expanded particles consisting of helical turns in a segment of said conduit.

6. In a furnace for heating an intumescing granular material held in suspension in combustion gases, a substantially horizontally disposed zigzag tubular conduit comprising segments of tubing joined together at their ends at obtuse angles, adapted to carry a stream of heated gases with suspended mineral particles from a feed end to a delivery end; burner means directed into said conduit at two or more of the angles thereof; means for feeding granular material into the feed end of said furnace; a helical coiled tubing forming one segment of said conduit, said coiled tubing being adapted to segregate unexpanded and heavy particles of mineral from the fully expanded particles; and means to vary the general slope of said furnace.

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