June 23, 1959

B. F. BUFF

2,891,320

ORE COOLING APPARATUS

Filed Sept. 16, 1955

2 Sheets-Sheet 1

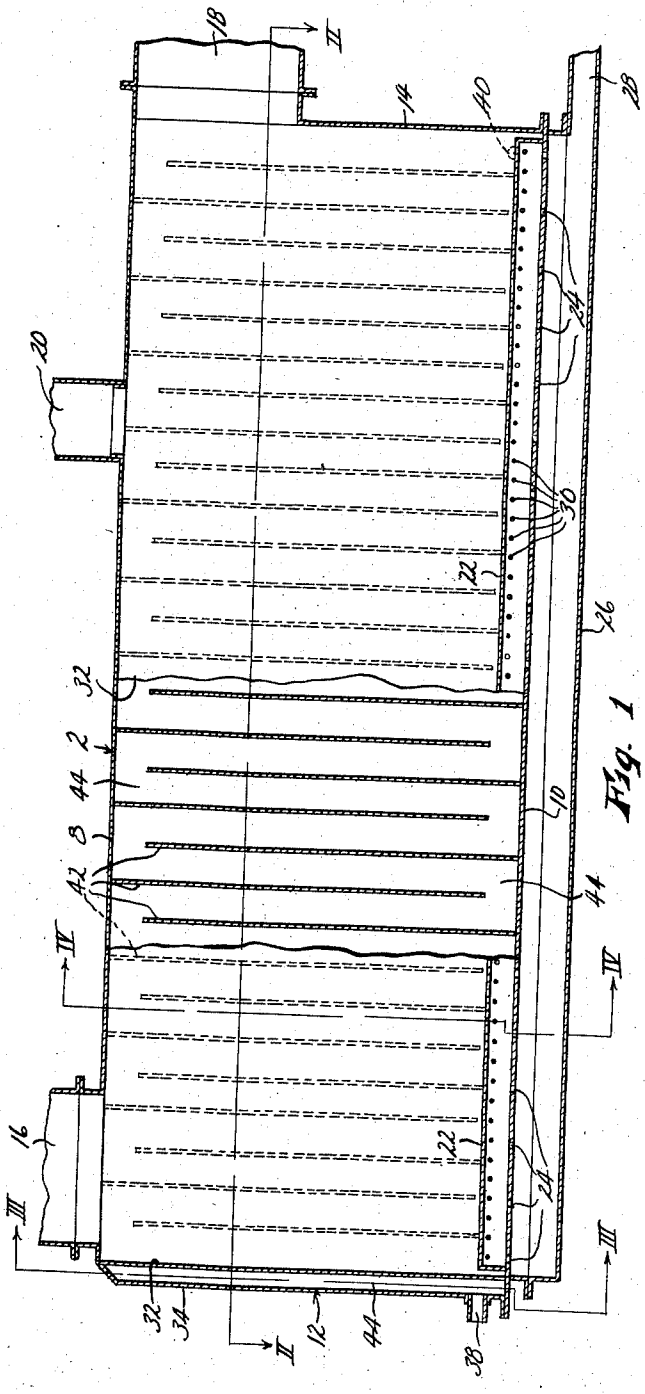

Fig. 1

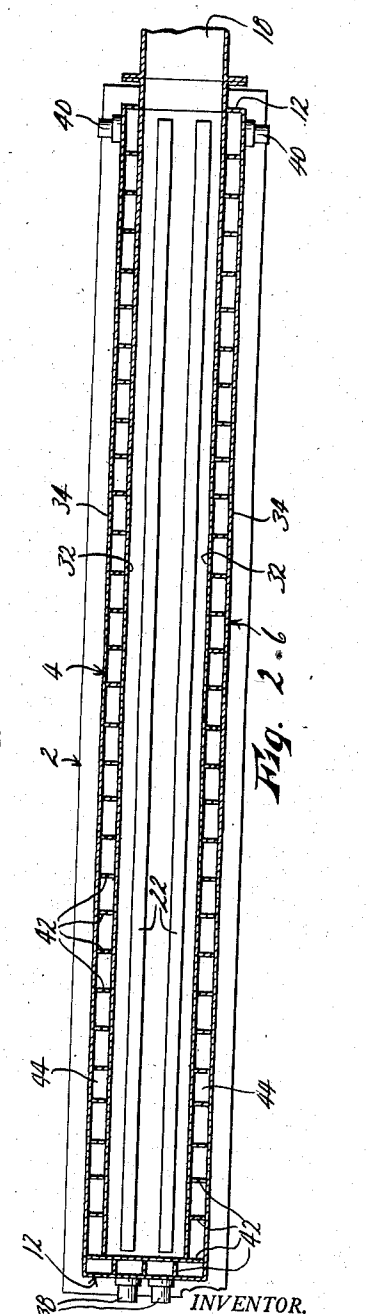

Fig. 2

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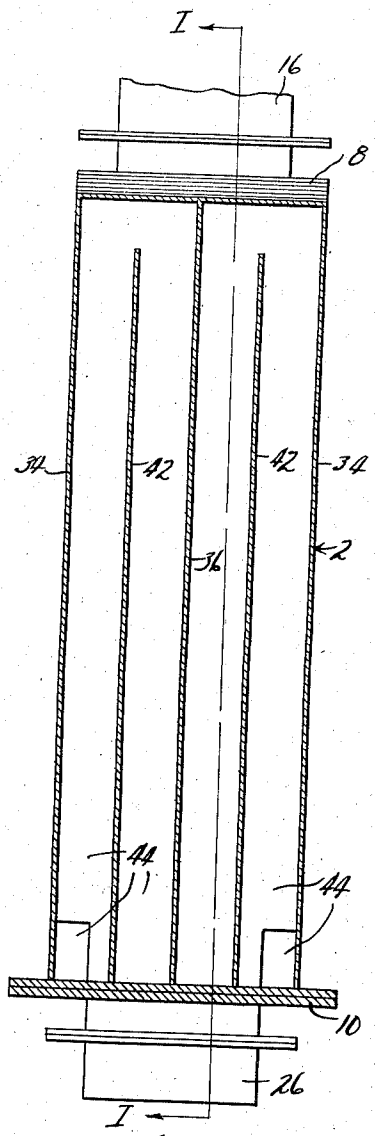

Fig. 3

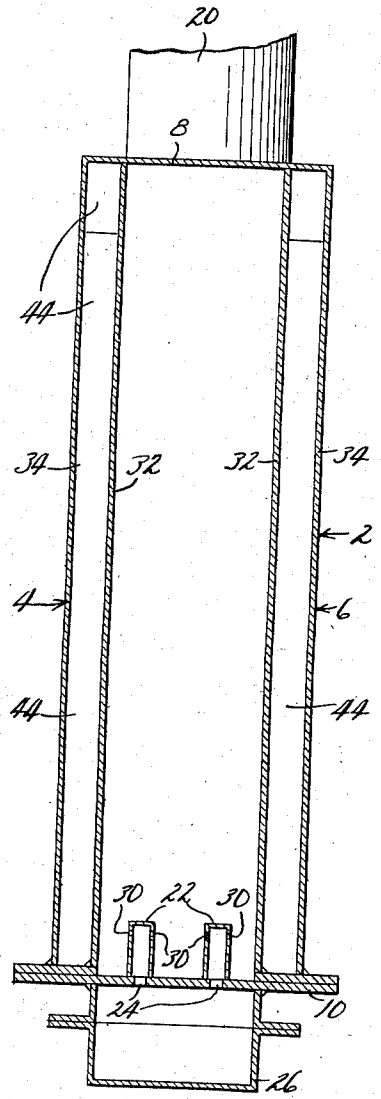

Fig. 4

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ORE COOLING APPARATUS

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Application September 16, 1955, Serial No. 534,807

1 Claim. (Cl. 34—57)

This invention relates to new and useful improvements in ore cooling apparatus, and has particular reference to the cooling of ore which is in a finely divided or powdered form.

In the refinement of zinc ore, the ore is first finely ground and subjected to a preliminary oxidization in a roasting step, from which it emerges at a temperature of about 1200 deg. Fahrenheit. Before it can safely be transferred by belting or other conveying equipment to position for subsequent steps in the refining process, it must be cooled to a point where it will not damage the conveying equipment, say about 300 deg. Fahrenheit.

The principal object of the present invention is, therefore, the provision of a novel apparatus which will perform the cooling function rapidly, efficiently and economically. This object is accomplished, generally, by delivery of the hot ore to a suitable container in which air is forced upwardly through the ore. The air of course produces a degree of direct cooling, but its most important effect is to "fluidize" the ore. The ore particles are virtually suspended by the rising air, the ore bed increasing substantially in volume and depth, and will flow freely with many of the properties and characteristics of an actual liquid. The ore thus flows from the inlet to the outlet of the container, with sufficient turbulence to cause thorough contact of the ore with the container walls, which are cooled as by water circulating therein. The walls may be spaced closely together to obtain more efficient heat transfer.

Other objects are simplicity and economy of construction, efficiency and dependability of operation, and adaptability for treating many materials other than ore.

With these objects in view, as well as other objects which will appear in the course of the specification, reference will be had to the drawing, wherein:

Fig. 1 is a reduced longitudinal sectional view of an ore cooling apparatus embodying the present invention, taken on line I—I of Fig. 3, partially broken away,

Fig. 2 is a sectional view taken on line II—II of Fig. 1, and

Figs. 3 and 4 are enlarged sectional views taken respectively on lines III—III and IV—IV of Fig. 1.

Like reference numerals apply to similar parts throughout the several views, and the numeral 2 applies generally to the cooler, which comprises essentially a rectilinear container having side walls 4 and 6, top wall 8, bottom wall or floor 10, and end walls 12 and 14. An ore inlet opening 16 is formed in top wall 8 adjacent end wall 12, and an ore outlet opening 18 is formed in end wall 14 at the top thereof. An air outlet opening 20 is formed in top wall 8.

A pair of inverted channel members 22 extend substantially the entire length of floor 10, being welded or otherwise permanently secured to said floor, and are each adapted to receive air through a series of holes 24 formed in spaced relation through said floor. Said holes interconnect said channels with an air chest 26 secured to the lower side of said floor, and to which air under pressure

is delivered by a suitable blower, not shown, through conduit 28. Each of the vertical side walls of each channel 22 has a series of spaced apart holes 30 formed horizontally therethrough, and adapted to direct air horizontally outwardly, substantially at right angles to side walls 4 and 6.

Side walls 4 and 6 and end wall 12 are double, each comprising inner and outer plates 32 and 34 which are spaced apart to form a chamber extending around three sides of the cooler. Said chamber is divided by a vertical partition 36 disposed midway of end wall 12, each of the two chambers thus formed having an inlet fitting 38 adjacent partition 36 for the introduction of cooling water, and an outlet fitting 40 adjacent end wall 14. Each of the chambers is divided by a plurality of baffle plates 42 into a serpentine passageway 44 through which the water must flow and which insures that said water will be circulated thoroughly over the entire areas of the affected walls. Water flowing from outlets 40 is preferably recirculated through a common cooling tower back to inlets 38.

In operation the hot, powdered or granulated ore is fed into the cooler through inlet 16, and air under pressure is directed through conduit 28, air chest 26, holes 24, channels 22 and holes 30 into the bottom portion of the cooler, whence it forces its way upwardly through the ore mass, causing a separation of the ore particles and virtual air suspension thereof, causing the ore to flow freely in the manner of a fluid. Due to this "fluidization" the ore will fill the container from end to end and will, when it reaches the level of outlet 18, flow through said outlet. In traveling the length of the container, the ore will be cooled efficiently by its contact with the water-cooled walls. The thoroughness and efficiency of this contact is improved by the air-induced turbulence of the ore particles, and by the large area of the side walls, which due to their close proximity present a very large area in proportion to the capacity of the container. Ore flowing through outlet 18 is thereby reduced to a temperature safe for belting or other handling and conveying equipment.

Air is exhausted through outlet 20, and any ore particles entrained therein may be separated therefrom by any suitable dust collecting apparatus, not shown and not in itself forming any part of the present invention. Ore outlet 18 may be fitted with an air trap, also not shown. The air pressure required, however, is sufficiently low that there is no pronounced tendency for the ore to be entrained in the air stream. A pressure of 3–5 p.s.i. for an ore bed 3–4 feet thick has been found satisfactory, although this may of course be varied with the depth of the ore bed, and the fineness of the powdered or granular material being treated.

The fact that air is directed horizontally into the container at the bottom thereof, and impinges on the side walls before it is directed upwardly, creates a greater turbulence and prevents the formation of pockets where the ore can pack solid and stationary, which would thereafter hold the "fluidized" ore out of contact with the walls and reduce the efficiency of the cooler. With the low pressure noted above, there is no consequential "sand blast" damage to the side walls, but only a polishing effect. If higher pressures were used, or more abrasive materials treated, the side walls could be protected by hardened inserts or overlays.

The horizontal disposition of holes 30 also prevents the back flow of ore into channels 22 when the air supply is shut off, if the walls of said channel are sufficiently thick in relation to the diameters of the holes. One-eighth inch holes in one-quarter inch plate have been found satisfactory, but this is of course illustrative

only. Due to the angle of repose of granular materials, the ore can enter the holes, but not pass entirely therethrough. If desired for this purpose, holes 30 could also be inclined downwardly and outwardly, or flanges could be affixed to the channels and overhanging the holes.

While I have shown and described a specific embodiment of my invention, it is apparent that many minor changes of structure and operation, such as those described above, could be made without departing from the spirit of the invention as defined by the scope of the appended claim.

What I claim as new and desire to protect by Letters Patent is:

An ore cooling apparatus comprising a container having spaced apart ore inlet and outlet openings at or adjacent the top thereof for the admission and discharge of finely divided or powdered ore, certain of the walls of said container being compartmented for the circulation of a cooling fluid therethrough, and means whereby air under pressure may be admitted to said container at or adjacent the bottom thereof, said air admitting means comprising a channel member secured to the floor of said container and extending upwardly therefrom to form an air duct extending along the floor of said container in spaced relation from the side walls thereof, to which air under pressure may be supplied, said channel having vertically extending side walls with spaced apart openings formed horizontally therethrough, through which air is directed outwardly to impinge on the side walls of said container.

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