May 10, 1932. H. K. A. LASSEN 1,857,725

ROASTING APPARATUS

Filed May 14, 1930 2 Sheets-Sheet 1

Fig. 1.

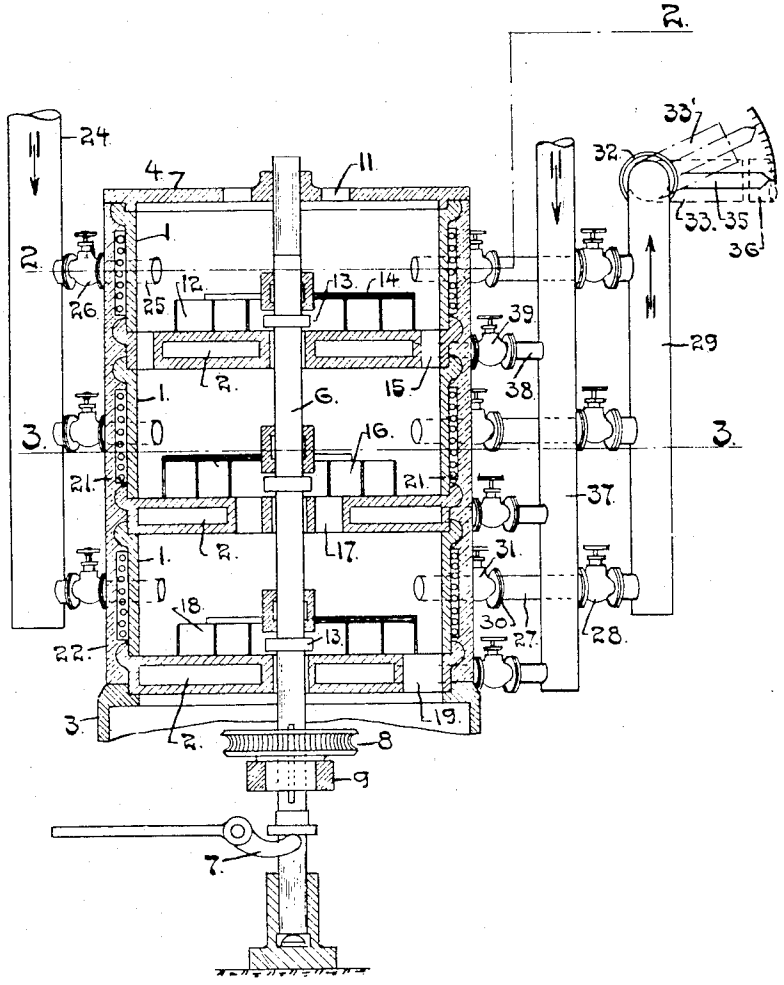

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Fig. 2.

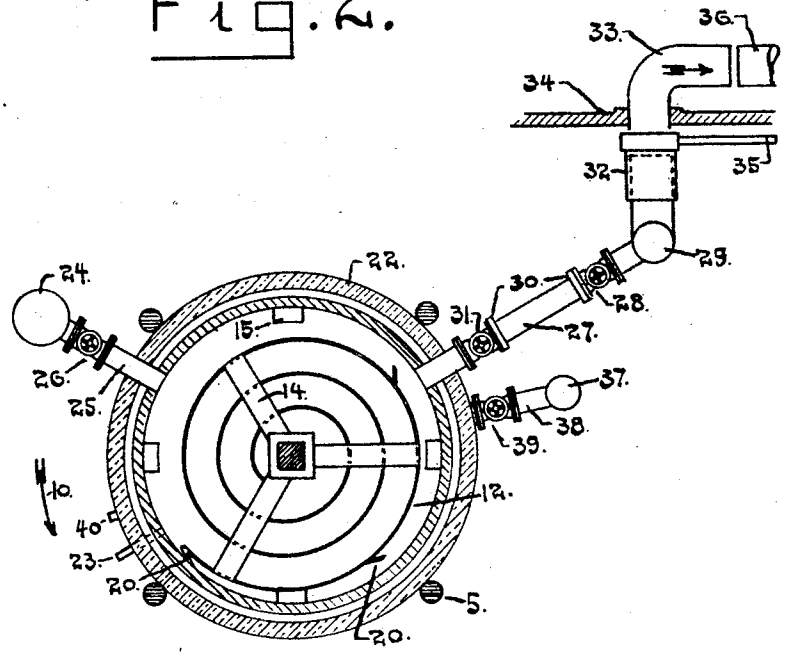
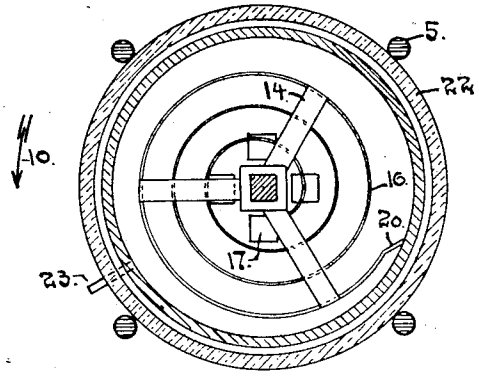


Fig. 3.



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UNITED STATES PATENT OFFICE

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ROASTING APPARATUS

Application filed May 14, 1930, Serial No. 452,382, and in Norway May 18, 1929.

The present invention relates to a furnace for roasting sulphide ores. The furnace is particularly adapted for roasting sulphides of iron in order to convert them into magnetic compounds which subsequently may be separated from the still nonmagnetic valuable constituents of the material in a magnetic separator. The furnace may however be used generally for the roasting of sulphides.

The accompanying drawings illustrate—partly diagrammatically—the construction of the furnace and its manner of working. The furnace is of the known shelf construction, but on account of several particular devices it represents a novel type of shelf burner.

Fig. 1 is a vertical section of the furnace.

Figs. 2 and 3 show horizontal sections along the lines II—II and III—III of Fig. 1.

The furnace is built up of cylindrical shelf compartments 1 with hollow bottoms 2. In the embodiment shown the furnace has three shelves but may of course be built up of any desired number of shelves. The lowermost bottom is supported by a frame 3, and the uppermost compartment carries a cover 4, which is connected to the frame 3 by means of four rods 5. In the centre of the furnace a vertical revolving shaft 6 is provided, the lower end of which rests on a lever 7. The middle portion of the shaft is of square section, while the ends are cylindrical. The shaft carries a worm-wheel 8, having a sleeve-shaped hub, which is capable of being turned in a stationary bearing 9. The worm-wheel is driven in the direction of the arrow 10 from a horizontal worm shaft, not shown in the drawings. The worm-wheel 8 is connected to the shaft 6 by means of slot and key in such a manner, that the shaft rotates with the worm-wheel, but may be displaced axially relatively to the latter by moving the lever 7 upwards or downwards. By means of a feeding device (not shown) the ore to be roasted is supplied to the top shelf of the furnace through four openings 11 in the top cover 4 near the centre of the latter and is distributed by means of a spiral-shaped rabbling device 12. This rabbling device is provided with a quadrangular hub surrounding the shaft 6 with slight clearance so that the rabbling device is resting on the bottom plate 2 and is moved from the shaft without being supported by it. Below the hub the shaft carries a ring 13, which normally is not in touch with the hub, but when the shaft is raised as mentioned above by means of the lever 7 this ring 13 presses against the hub, which together with the rabbling device is displaced upwards. If the lever 7 is released or is moved quickly downwards, the rabbling device will by its own weight fall down upon the bottom 2 and suffers thereby vibrations. Such shaking of the rabbling device may be used from time to time according to the nature of the ore under treatment in order to free the device from material adhering thereto. The distance between the spiral windings of the device is decreasing from the centre towards the periphery, and the windings are stiffened by means of strips 14 across their upper edges. In the uppermost compartment the bottom 2 is provided with four openings 15 at the periphery, through which the material falls down into the next compartment. In this a spiral-shaped rabbling device 16 is provided in which the windings are of opposite direction of that of the spiral 12 so that in this compartment the material is conveyed towards the centre, from where it falls down into the lowermost compartment through four openings 17. In this latter compartment a spiral device 18 of like construction as that in the uppermost compartment conveys the material towards the periphery. The material leaves the furnace through an opening 19 in the lowermost bottom 2. The rabbling devices 16 and 18 are arranged just as the rabbling device 12 and may be raised by means of rings 13 fixed on the shaft 6 when the latter is displaced upwards. In order to prevent the material from accumulating along the periphery beyond the reach of the rabbling devices the latter are provided with projecting strips 20 extending outwardly. The heating of the furnace is effected by means of electric heating units 21 arranged in belts around the respective compartments. The entire fur-

nace is surrounded by a heat-insulating jacket 22. This jacket may be provided with doors, not shown in the drawings. In each of the roasting compartments a thermocouple 23 is provided for control of the temperature. The necessary air for carrying out the process is supplied under pressure through a measuring apparatus (not shown) from a main pipe 24, which by branch pipes 25 communicates with the several roasting compartments. In each branch pipe a regulating valve 26 is inserted. The openings 15 and 17 in the bottoms 2 are of such dimensions that air and gas freely and without hindrance from the ore may pass through the whole furnace. The gases leave each roasting compartment through pipes 27 with regulating valves 28 and a common main flue 29. To facilitate cleaning the pipes 27 are made easily detachable by insertion of two couplings 30. In each pipe is further provided a shut-off valve 31, for use when the pipes are disengaged. The gas flue 29 extends into a sleeve 32 of a curved pipe 33, through which the gases pass into a separate chamber of which only one wall 34 is shown in the drawings. The short pipe 33 is able to be turned in the wall 34, for which purpose a lever 35 may serve, which is mounted on the sleeve 32. Thereby this sleeve 32 is turned about the end of the pipe 29. In the position of the pipe 33 shown in the drawings the flue gases will continue through the stationary flue 36, which leads to a fan. By turning the pipe 33 more or less upwards relatively to the flue 36, the draught in the flue 29 may be regulated. If for instance the pipe 33 is brought into the position 33′ in Fig. 1 the suction in the flue 29 is shut off. Behind the lever 35 a stationary scale may conveniently be arranged on which the lever 35 indicates the actual position of the pipe 33 and consequently the amount of draught just prevailing in the tube 29.

By regulation of the air and gas valves and the position of the pipe 33 the following effects are realized just according to requirements and independent of variations in the content of sulphides in the ore:

A convenient distribution of the supplied air in all parts of the furnace.

A uniform distribution of the roasting gases throughout the furnace or a successive increase of the concentration of the gases in the several compartments or a lowering of the concentration of the gases in the whole furnace or in its several compartments.

In order to obtain exact regulation of the temperature in the several furnace compartments it is of importance to provide cooling of the bottoms 2. On these bottoms the burning of the sulphides take place, which constantly imparts to the bottoms a supply of heat, which must be regulated. This is effected by air which is blown into the hollows of the bottoms from the main 37 through branch pipes 38 with regulating valves 39. This air has no access to the roasting compartments, it only passes through the hollow bottoms and escapes into the atmosphere through short sleeves 40 (Fig. 2).

I claim:

1. Furnace for roasting sulphide ores comprising a plurality of superposed compartments, rabbling devices in the compartments, a main pipe for supplying air to the furnace, from said main pipe branch pipes for independent and adjustable supply of air to the several roasting compartments, from each roasting compartment an escape pipe for adjustable removal of roasting gases, a common pipe connected with the several escape pipes, and means for regulating the draft in said common pipe.

2. Furnace for roasting sulphide ores comprising a plurality of superposed compartments, in each compartment a single spiral-shaped device for rabbling and transport of the ore, a main pipe for supplying air to the furnace, from said main pipe branch pipes for adjustable supply of air independently to the several roasting compartments, from each roasting compartment a pipe for adjustable escape of roasting gases, a common pipe connected with the several escape pipes and means for regulating the draft in said common pipe.

3. Furnace for roasting sulphide ores comprising a plurality of superposed compartments, in each compartment a spiral-shaped rabbling device, means for raising and suddenly dropping said devices upon the bottom of the roasting compartment during the work of the furnace, a main pipe for supplying air to the furnace, from said main pipe branch pipes for adjustable supply of air to the several roasting compartments, from each roasting compartment a separately adjustable pipe for the escape of roasting gases, a common pipe connected with the several escape pipes, and means for regulating the draft in said common pipe.

4. Furnace for roasting sulphide ores comprising a plurality of superposed compartments, each compartment having a hollow bottom, means for adjustable air cooling of the upper part of said bottom, in each compartment a spiral-shaped rabbling device, means for raising said rabbling device and for suddenly dropping it upon the bottom of the roasting compartment, a main pipe for supplying air to the furnace, from said main pipe branch pipes for independently adjustable supply of air to the several roasting compartments, from each roasting compartment a separately adjustable pipe for escaping roasting gases, a common pipe connected with the several escape pipes, and means for regulating the draft in said common pipe.

5. Furnace for roasting sulphide ores comprising a plurality of superposed roasting compartments, separately adjustable electrical heating units, one surrounding each compartment, spiral-shaped rabbling devices in said compartments, means for raising and suddenly dropping said devices upon the bottom of the roasting compartment during the work of the furnace, a hollow bottom in each compartment, means for adjustable air cooling of the upper part of said bottoms, a main pipe for supplying air to the furnace, from said main pipe branch pipes for adjustable supply of air independently to the several roasting compartments, from each roasting compartment a separately adjustable pipe for the escape of roasting gases, a common pipe connected with the several escape pipes and means for adjustable artificial draft in said common pipe.

In testimony that I claim the foregoing as my invention I have signed my name.

HANS KARL ANDREAS LASSEN.