May 24, 1927. 1,629,968

A. H. RICHARDS

METALLURGICAL FURNACE FEEDING MECHANISM

Filed Sept. 24, 1923 2 Sheets-Sheet 1

Fig 1

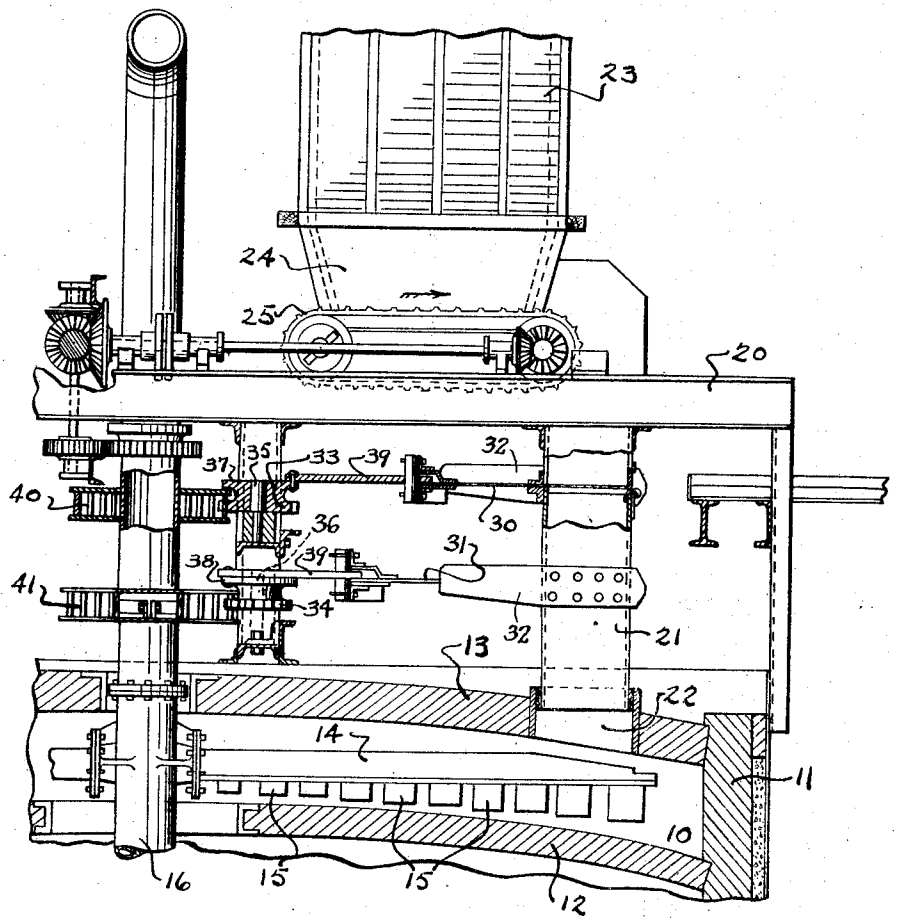
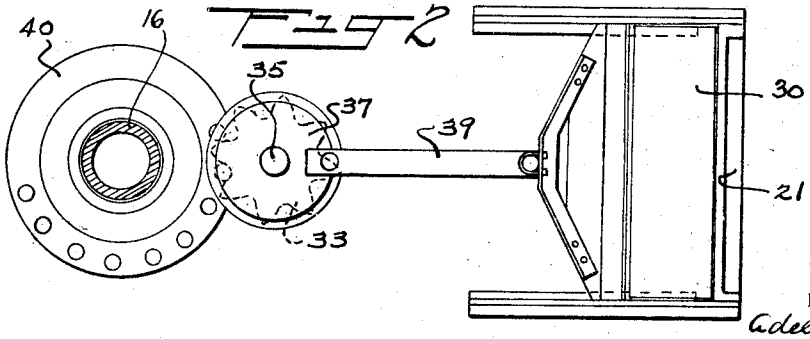


Fig 2



INVENTOR
Adelbert H. Richards
BY
Albert M. Austin
ATTORNEY

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A. H. RICHARDS

METALLURGICAL FURNACE FEEDING MECHANISM

Filed Sept. 24, 1923 2 Sheets-Sheet 2

Fig 3

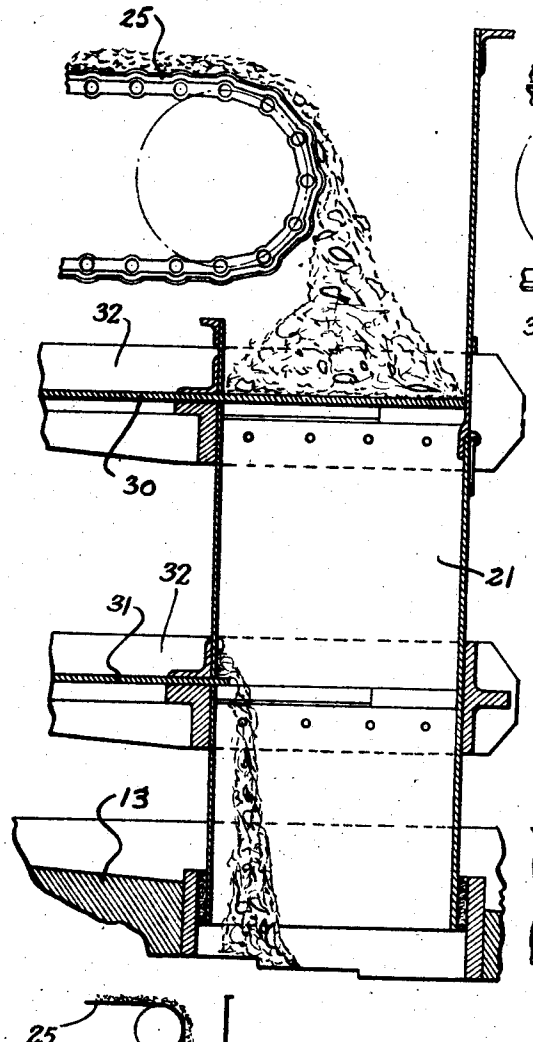


Fig 4

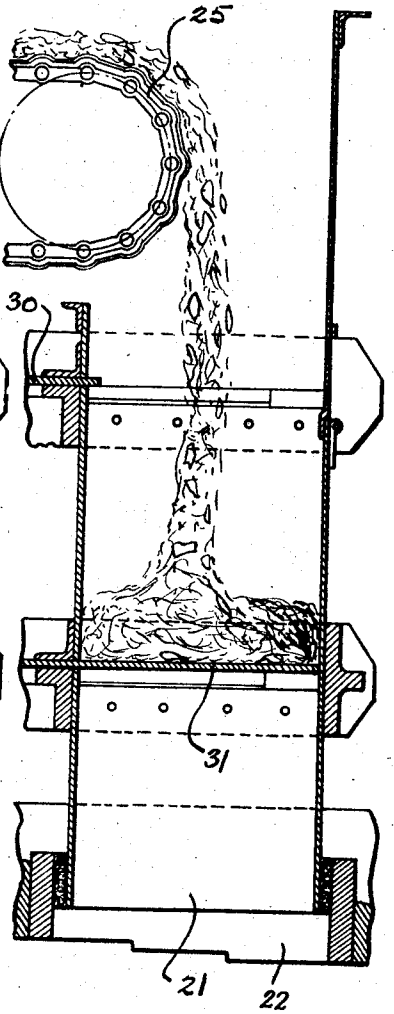
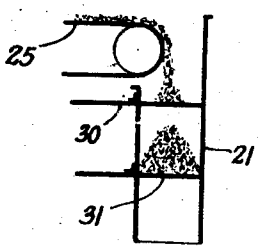


Fig 5



INVENTOR
Adelbert H. Richards
BY
Albert W. Curtis
ATTORNEY

Patented May 24, 1927. 1,629,968

UNITED STATES PATENT OFFICE.

ADELBERT HARRY RICHARDS, OF SALT LAKE CITY, UTAH, ASSIGNOR TO AMERICAN SMELTING AND REFINING COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

METALLURGICAL-FURNACE-FEEDING MECHANISM.

Application filed September 24, 1923. Serial No. 664,377.

This invention relates to a method of and apparatus for feeding a metallurgical furnace so that the charge will be fed into the furnace without exit of gases from within the furnace and without admission of relatively cold air.

The invention is especially adapted for use in connection with roasting furnaces and particularly relates to the class of furnaces that receive measured charges from a continuous feeder.

The invention also relates to the construction and operation of suitable mechanism for carrying out the invention that will be efficient in operation and simple in construction.

The invention further relates to various novel features of the method and improvement in the apparatus which in part will be obvious from an inspection of the accompanying drawings and which in part will be more fully set forth in the following description.

In the accompanying drawings,

Figure 1 shows a sectional elevation including the driving gears;

Figure 2 shows a plan view partly in section;

Figure 3 shows a sectional elevation of a form of feeding mechanism embodying the present invention with the upper gate closed;

Figure 4 shows the same sectional elevation with the other gate closed; and

Figure 5 is a schematic view of the valves in their sealing position.

Referring to the accompanying drawings, the furnace 10 may be of conventional design, having an insulated side wall 11, a curved top deck 12, and a roof 13. The under surface of the top deck 12 is positioned immediately above the combustion chamber of the furnace and subjected to a high temperature in any desired manner well known in the art. Above the upper surface of the deck 12 is a rotatable arm 14 having a plurality of rabbles, such as 15, adapted to stir the material when the rabble arm is rotated by a centrally positioned drive shaft or rotating column 16.

A framework 20 comprising suitable beams and trusses extends above the furnace, and suspended from this framework is a vertical chute 21, which communicates with the interior of the furnace through an opening 22 in the roof. The charge comprising ore or material to be treated in the furnace may be supplied from a suitable bin 23, preferably provided with a hopper 24. The material may be conveyed from the bin to the chute by a measured quantity feeder or apron feeder 25, which leads to the upper end of the chute 21 and delivers the charge thereto.

The chute is divided into one or more compartments by two or more movable gates, spaced apart a sufficient distance to hold a measured charge of any predetermined quantity between them. In the particular apparatus illustrated in the drawing the chute is divided into an upper inlet section, a central or holding compartment and a discharge of feeding section by two gates 30, 31. When both of the gates are shut they form a closed chamber that is sealed from the furnace gases within and the relatively cold air without. The gates slide in suitable guide frames 32 which may be formed integral with the walls of the chute and are preferably arranged in a horizontal position. Although two such gates are shown in the accompanying drawing a greater number may be used if desired.

In order to operate the gates alternately and intermittently star wheel pinions 33, 34 are mounted on suitable gudgeons 35, 36, respectively, and are secured to or formed integral with crank disks 37, 38. Each disk is connected by suitable means such as the connecting rod 39 with the slide gates 30, 31, respectively. The star wheels in turn mesh with the lantern gears 40 and 41 driven from any suitable source of power, such as the rotating column 16. The lantern gears are provided with pins on opposite segments so that while one such gear is in mesh with its coacting star wheel and the corresponding gate is being actuated, the other star wheel will be at rest and the gate with which it is operatively connected will remain in its closed position. The number of pins on each lantern gear registers with the number of teeth on the cooperating star wheel, and an advance of the sector of the lantern gear containing the pins will cause a complete revolution of the star wheel and disk, thereby opening and closing its associated gate.

The lantern gears may revolve continuously and are preferably so mounted that the sectors containing the pins or teeth are positioned at an angle of at least 180 degrees with respect to each other, thereby to insure a moment of rest after one gate has closed and before the other gate is opened.

In operation and with the gates in the position shown in Figure 3, the charge will be delivered to the upper or inlet portion of the chute by the feeder and rest upon the upper gate 30, which remains in its closed position while the lower gate is being opened and shut. After the lower gate 31 has been closed, continued rotation of the shaft carrying the lantern gears causes the upper gate 30 to be actuated to open and close while the lower gate remains at rest in its closed position as shown in Figure 4. This reciprocation of the upper gate drops the charge onto the lower gate, which will remain at rest until the upper gate is closed, as in Figure 5. Thereafter the lower gate is actuated and when it opens the charge is dropped into the furnace but no furnace gases can escape, as the chute is completely blocked by the upper gate. This cycle of operations is regularly repeated, there being a time interval when both gates are closed for a period determined by the position of the pins but only one gate is open at a time.

Thus it will be seen that I have provided a system of feeding particularly adapted for metallurgical furnaces in which the loss of gases and volatilized matter from the interior of the furnace is prevented. The feeding chute leading into the furnace is effectively divided into one or more compartments by reciprocating gates. The operating mechanism for these gates is such that each can only operate when the other gate is at rest in its closed position. The measured charge of concentrates is deposited from the endless belt conveyor upon the upper gate and when the gate is opened it falls upon the lower gate and remains there until the upper gate is closed. For a period the charge is retained within the sealed chamber formed by the two closed gates. The lower gate then opens so that the charge falls by gravity on the top deck within the roaster ready to be distributed by the rotating rabble arm. After the lower gate has closed the feeding operation is repeated by the opening and closing of the upper gate. At no time does the interior of the roaster communicate with atmosphere. The operation of the gates is such that the sealed compartment alternately communicates with the interior of the roaster and with atmosphere, but not with both, whereby the efficiency of the furnace will be increased and the unfavorable conditions accompanying the operation of roasting units at the present time which are detrimental to the health of the attendants will be alleviated.

While retained in the chamber formed by the two closed gates the charge is subjected to the heat communicated to the chamber by the heat of the adjacent furnace, and the efficiency of the operation is greatly enhanced. The material of the charge is unexposed to the atmosphere during the heat treatment being protected therefrom by means of the upper gate 30, and it will be seen that after the beginning of the heat treatment the material is not again exposed to the atmosphere. It is discharged into the furnace, and it will be noted that since the rabble arm 14 and the lower gate 31 are operatively connected to the same source of power or column 16, there is a fixed cyclic relation between the opening of the gates and the rotation of the rabble arm.

The operative mechanism illustrated is, however, extremely simple and particularly well adapted to roasting furnaces. The lantern gears are constructed so as to be readily affixed to the same source of power that operates the rabble arm and thus the cost of installation and the cost of operation is minimized.

While I have shown and described and have pointed out in the annexed claims certain novel features of my invention, it will be understood that various omissions, substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of my invention.

Having thus described my invention, I claim:

1. In a furnace having a feed chute with a plurality of feed gates therein for feeding charges to said furnace, a drive shaft having a wheel for each gate, each wheel having an operating sector and a non-operating sector and a separate device for opening and closing each gate, each of said devices being operated by the operating sector of the respective wheel and not operated by the non-operating sector of said wheel.

2. In a furnace having a feed chute with a plurality of feed gates therein for feeding charges to said furnace, a drive shaft having a wheel for each gate, each wheel having an operating sector and a non-operating sector and a separate device for opening and closing each gate, each of said devices being operated by the operating sector of the respective wheel and not operated by the non-operating sector of said wheel, said operating sectors being at substantially 180 degrees from each other.

3. In a furnace having a feed chute with feed gates for feeding charges to said furnace, gears mounted on said shaft, each having an operating sector and a non-operating

sector, a counter shaft, wheels mounted on said counter shaft in operative relation with said gears, each of said wheels having an operative connection with its respective feed gate.

4. In a furnace having a feed chute with spaced feed gates for feeding charges to said furnace, a drive shaft, gears mounted on said shaft, each having a sector less than 180 degrees provided with operating teeth and a sector without teeth, said gears having their sectors containing the teeth at substantially 180 degrees with each other, a counter shaft, star wheels having teeth and mounted on said counter shaft in operative relation with said gears, each of said star wheels having operative connection with its respective feed gate, said star wheels being of such size that an advance of one sector containing teeth causes a complete revolution of the respective star wheel.

5. In a furnace having a feed chute with spaced sliding feed gates for feeding charges to said furnace, gears mounted on said shaft, each having a sector provided with teeth and a sector without teeth, said gears having their sectors containing the teeth at substantially 180 degrees with each other, a counter shaft, star wheels having teeth mounted on said counter shaft in operative relation with said gears, each of said star wheels having a crank pin and connecting rod extending to its respective feed gate.

6. In a furnace having a feed chute with spaced sliding feed gates for feeding charges to said furnace, lantern gears mounted on said shaft, each having a sector less than 180 degrees provided with pins and a sector without pins, said lantern gears having their sectors containing the pins at substantially 180 degrees with each other, a counter shaft, star wheels mounted on said counter shaft in operative relation with said lantern gears, each of said star wheels having a crank pin and connecting rod extending to its respective feed gate, said star wheels being of such size that an advance of one sector containing pins causes a complete revolution of the respective star wheel.

7. In a furnace having a feed chute with spaced sliding feed gates for feeding charges to said furnace and a rabble arm for distributing said charges, a vertical rotating column on which said rabble arm is mounted, lantern gears mounted on said column, each having a sector less than 180 degrees provided with pins and a sector without pins, said lantern gears having their sectors containing the pins at substantially 180 degrees with each other, a counter shaft, star wheels mounted on said counter shaft in operative relation with said lantern gears, each of said star wheels having a crank pin and connecting rod extending to its respective feed gate, said star wheels being of such size that an advance of one sector containing pins causes a complete revolution of the respective star wheel.

Signed at Garfield in the county of Salt Lake and State of Utah Sept. 18th, A. D. 1923.

ADELBERT HARRY RICHARDS.