

June 9, 1931.

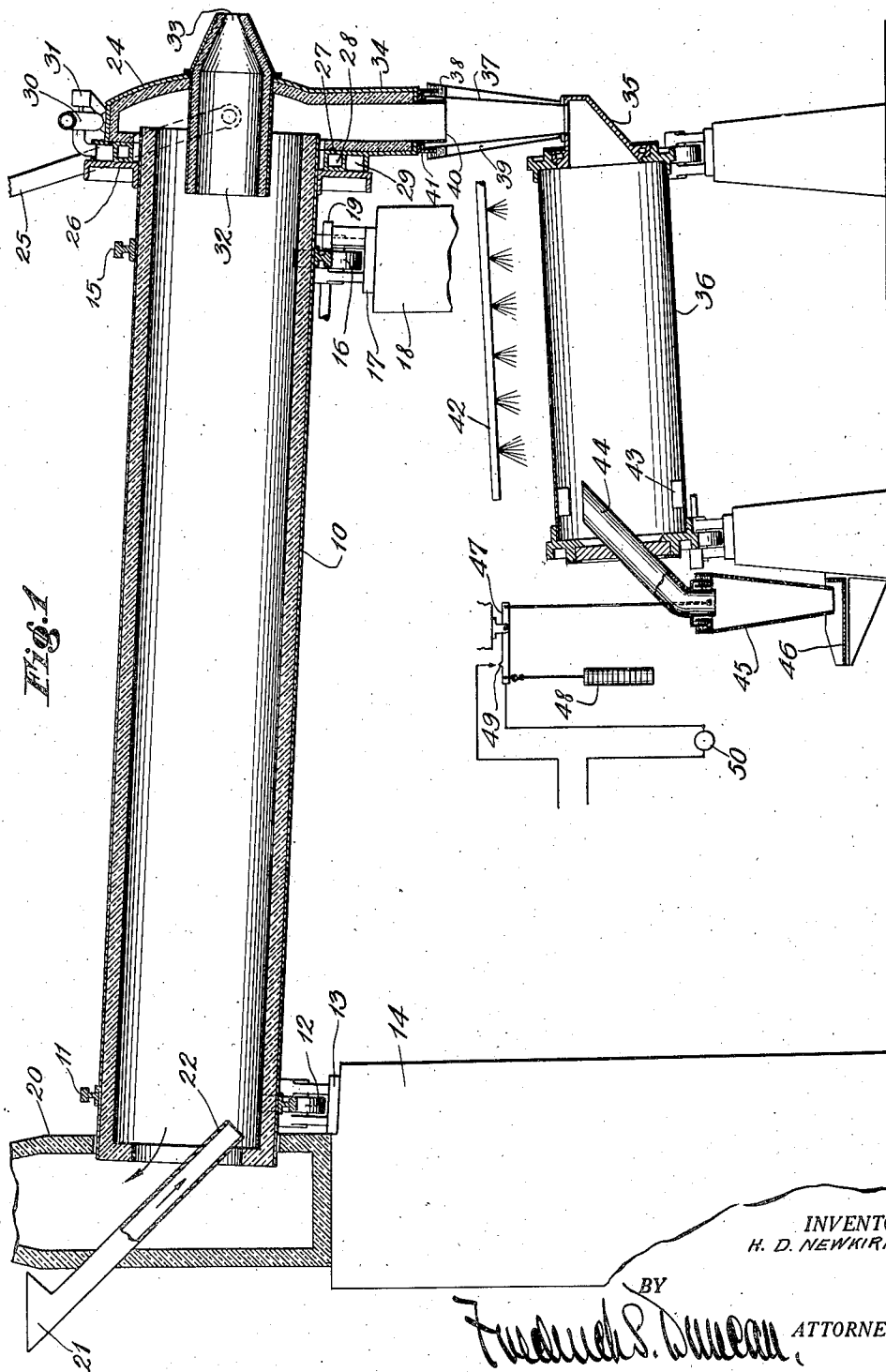
H. D. NEWKIRK

1,809,563

ROTARY FURNACE

Filed June 18, 1929

2 Sheets-Sheet 1



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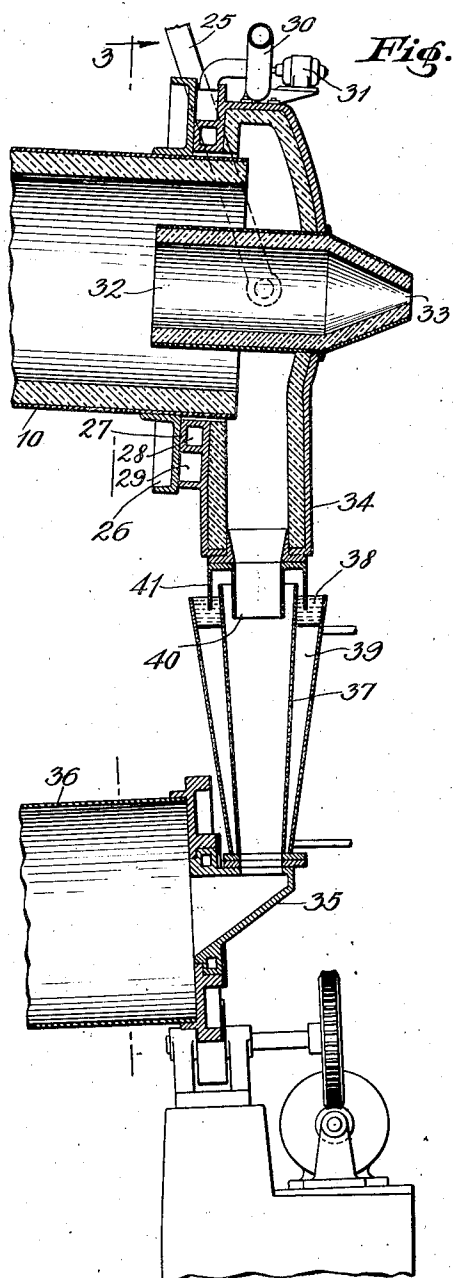
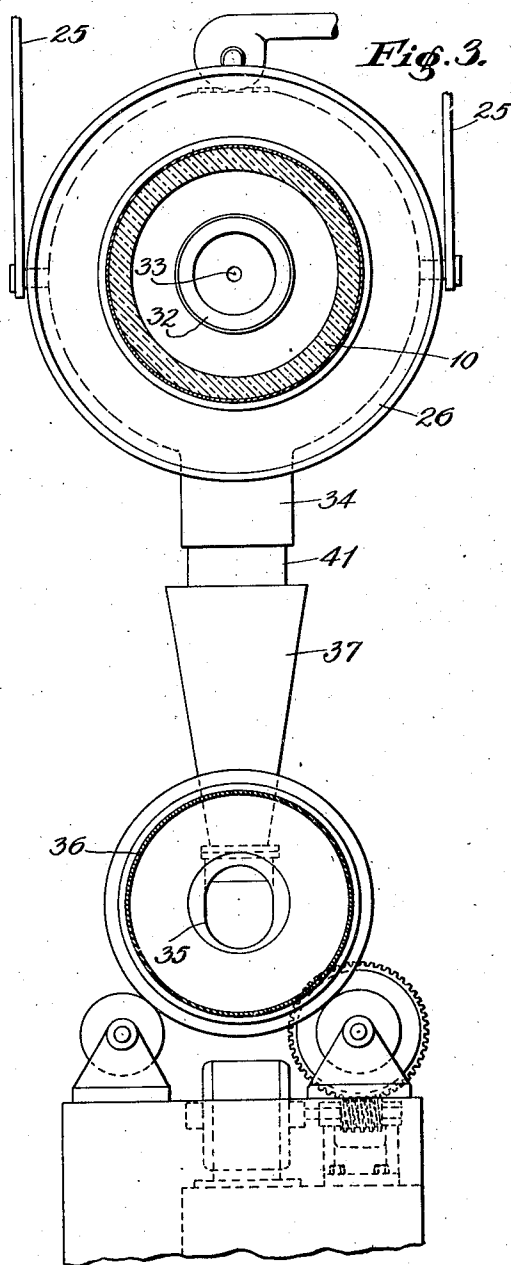
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ROTARY FURNACE

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2 Sheets-Sheet 2



INVENTOR.
H. D. NEWKIRK

BY
Frederick S. Duncan ATTORNEY

UNITED STATES PATENT OFFICE

HARLAND D. NEWKIRK, OF SYRACUSE, NEW YORK, ASSIGNOR TO ONONDAGA STEEL COMPANY, INC., A CORPORATION OF NEW YORK

ROTARY FURNACE

Application filed June 18, 1929. Serial No. 371,797.

My invention relates to improvements in rotary kilns or furnaces and relates more particularly to an improved means for sealing the joint between rotary and fixed parts of the furnace.

My invention is particularly adapted for use in processes in which it is desirable to exclude air. For example, in a certain continuous process of producing sponge iron, a mixture of finely divided iron ore and coal is subjected to heat in a rotary furnace, the heat being supplied by a fuel burner at the discharge end of the furnace which burner is furnished with a deficiency of air. The charge is heated sufficiently to convert the iron oxide into metallic iron, while a highly reducing atmosphere is produced by the carbonaceous gases from the coal and from the burner. It is essential in a furnace of this type that leakage of air into the furnace be eliminated. Heretofore, considerable difficulty has been experienced in attempting to exclude air at the discharge end of the furnace where the greatest heat is developed and where a joint must be provided between the rotary furnace and a fixed discharge head.

It is an object of my invention to overcome the difficulty by providing an improved seal between the rotary furnace and the discharge head.

Another object of the invention is to provide means for keeping the joint at the discharge head cool, so as to permit of keeping the joint properly lubricated.

Still another object of the invention is to maintain a partial vacuum around the bearing, so that in case of any leakage there will be an outflow of gas at the bearing rather than an inflow of air therein.

With these objects in view and others which will appear hereinafter, I shall describe a preferred embodiment of my invention, and shall thereafter point out the novelty and scope of the invention in the claims.

In the accompanying drawings:

Figure 1 is a view in longitudinal section of a rotary kiln provided with my improved seal;

Fig. 2 is a similar view, but on a larger

scale, of a portion of the kiln shown in Fig. 1; and

Fig. 3 is a view in section taken on the line 3-3 of Fig. 2.

As shown in Fig. 1, the furnace consists of a rotary cylinder 10 suitably lined with firebrick and preferably mounted on a slight incline, so that the material fed into the upper end of the furnace will gradually work down to the lower or discharge end. Fixed to the cylinder 10 near its upper or inlet end is an annular flange or rail 11 which runs on rollers 12 journaled in a bracket 13 mounted on a suitable pedestal 14. Near the discharge end the furnace cylinder is similarly provided with an annular rail 15 adapted to run on rollers 16 mounted on a bracket 17 which is supported on a pedestal 18. The bracket 17 also carries a roller 19 which turns on an axis normal to that of the cylinder 10 and bears against the side of the flange 15, so as to take the thrust due to the inclination of the cylinder.

The upper end of the cylinder 10 projects into a stack 20 adapted to carry off the products of combustion from the furnace, and the mixture of iron ore and coal is fed into the furnace from a hopper 21 through a chute 22 which passes through the stack 20.

At the opposite end of the furnace there is a swinging discharge head 24 which is supported by a pair of links 25. The links 25 are pivoted at a point such that the discharge head will be held by gravity against the end of the furnace. To take the thrust of the discharge head, the cylinder 10 is provided with an annular flange 26 secured thereon. The discharge head is also provided with an annular member or bearing ring 27 adapted to engage the face of the flange 26. The contacting surfaces of the flange and member 27 are greased so as to reduce friction and also to provide a seal at this point. The bearing member 27 is formed with a conduit 28 through which water is circulated to keep the bearing surfaces relatively cool and prevent vaporizing or carbonizing of the lubricant. Surrounding the water conduit 28 is an air conduit 29 which is open at the side adjacent the flange 26; in the other words,

the flange 26 forms one of the walls of the air conduit. Mounted on the discharge head 24 is a suction fan 30 driven by a suitable motor 31 and connected to the air conduit 29. By this means air is constantly being drawn out of the air conduit, maintaining a partial vacuum around the bearing ring or water conduit 28, so that any leakage which may occur at the joint between the bearing ring 27 and flange 26 will be outward in the direction of the air conduit.

It will be understood that this form of seal is particularly adapted for large furnaces which, because of their size and the weight of material they are apt to carry and also because of variations of temperature to which they are subjected, are likely to be distorted. Any bearing member such as the flange 26 secured to the end of such a furnace is apt to wobble as it rotates. Because of the gravitational bias of the discharge head toward the disk produced by the inclination of the suspension links 25, the bearing ring 27 will follow the irregular movements of the disk 26 and maintain contact therewith.

As shown in the drawings, the discharge head 24 is formed with a combustion chamber 32 which projects into the furnace 10 and at its upper end is conically tapered to a small diameter as indicated at 33. A burner (not shown) serves to feed a spray of fuel into the combustion chamber 32 with just sufficient air to support combustion, but the deficiency of air is such that a highly carbonaceous gas is produced. The combustion chamber 32 and also the discharge head 24 are suitably lined with firebrick or other refractory material, and the discharge head is provided with a discharge spout 34 which leads into a hopper 35 communicating with a cooling drum or cylinder 36. In a furnace of this type, it is desirable to keep the charge out of contact with air not only at the point of discharge from the furnace, but also thereafter, until its temperature has been reduced to a point below that at which serious oxidation could take place by exposure to air. Because the discharge head must oscillate in order to maintain contact with the disk 26, a flexible joint must be provided between the hopper 35 and the spout 34. To this end the hopper is formed with a fixed waterjacketed intake spout 37, as best shown in Fig. 2, which is provided at the top with an annular trough 38 adapted to be filled with oil. Water is circulated through the water space 39 in the spout 37 to keep the oil from becoming too hot and evaporating.

The discharge spout 35 terminates in a fitting 40 which enters the intake spout 37 and which is provided with a depending annular flange 41 adapted to dip into the oil contained in the trough 38. This connection provides an air seal with a certain freedom of movement between the spot 34 and the spout 37.

The mixture in the cylinder 10 discharges through the hopper 35 into the cooling drum 36 and is cooled by a spray of water from a spray-pipe 42. The cooling drum 36 is preferably inclined, so that the material will gradually feed from the hopper to the outlet end of the drum where it is picked up by paddles 43 and discharged into a tube 44, and thence into a weighing hopper 45. The latter is conically tapered and opens at its lower end upon a suitable support 46. The hopper 45 is suspended from a scale beam 47, and when sufficient material has accumulated in the hopper to overbalance a counterweight 48 on the scale beam, an electrical contact will be made at 49, closing the circuit of an alarm 50, which will indicate to an attendant that sufficient material has accumulated to require withdrawal from the support 45.

I do not claim as part of my invention the construction of the cooling drum or the weighing hopper 44 and associated parts. They are illustrated here merely to show how a continuous process of reducing the ore is maintained without any chance for air to come in contact with the ore until the latter has been properly reduced and cooled to a predetermined temperature.

I claim:

1. In a furnace a rotary cylinder and a bearing therefor, and suction means for producing a partial vacuum surrounding the area of engagement of the bearing and cylinder.
2. In a furnace a rotary cylinder and a bearing therefor, suction means for producing a partial vacuum surrounding the area of engagement of the bearing and cylinder, and means for cooling said area.
3. In a furnace comprising a rotary cylinder and a non-rotary head at one end of the cylinder, a pair of mutually engaging bearing members formed on the head and cylinder respectively, said members being formed to provide a conduit therebetween surrounding the bearing surfaces of the members, and suction means connected with said conduit.
4. In a furnace comprising a rotary cylinder and a non-rotary head at one end of the cylinder, a pair of mutually engaging bearing members formed on the head and cylinder respectively, said members being formed to provide a conduit therebetween surrounding the bearing surfaces of the members, and suction means connected with said conduit, one of said members being water-jacketed.
5. In a furnace comprising a rotary cylinder and a non-rotary head at one end of the cylinder, an annular flange on said end of the cylinder, said head being formed with an annular bearing surface adapted to engage the flange and with a channel surrounding the bearing surface, and a suction pump connected with said channel.
6. In a furnace comprising a rotary cyl-

inder and a non-rotary head at one end of the cylinder, an annular flange on said end of the cylinder, said head being provided with an annular bearing adapted to engage the
5 flange, said flange and bearing member being formed to provide an air conduit therebetween, and a suction pump connected with said conduit.

10 7. In a furnace comprising a rotary cylinder and a non-rotary head at one end of the cylinder, an annular flange on said end of the cylinder, said head being provided with an annular bearing surface adapted to engage the flange and with a channel surrounding the bearing surface, and a suction
15 pump mounted on the head and connected with said channel.

8. In a furnace comprising a rotary cylinder and a non-rotary head at one end of the
20 cylinder, an annular flange on said end of the cylinder, said head being provided with an annular bearing surface adapted to engage the flange and with a channel surrounding the bearing surface, a suction pump
25 mounted on the head and connected with said channel, and a motor operatively connected with the pump and also mounted on said head.

9. In a furnace comprising a rotary cylinder and a non-rotary head at one end of the cylinder, an annular flange on said end of the cylinder, said head being provided with an annular bearing surface adapted to engage the flange and with a channel surrounding the bearing surface, and a suction pump
35 connected with said channel, said member being also formed with a duct adjacent the bearing surface through which a cooling fluid may be passed.

40 In testimony whereof, I have signed this specification.

HARLAND D. NEWKIRK.

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