May 5, 1925. 1,536,226

C. E. LEHR

DEVICE FOR OPERATING OPEN HEARTH FURNACE DAMPERS

Filed Oct. 21, 1922 2 Sheets-Sheet 1

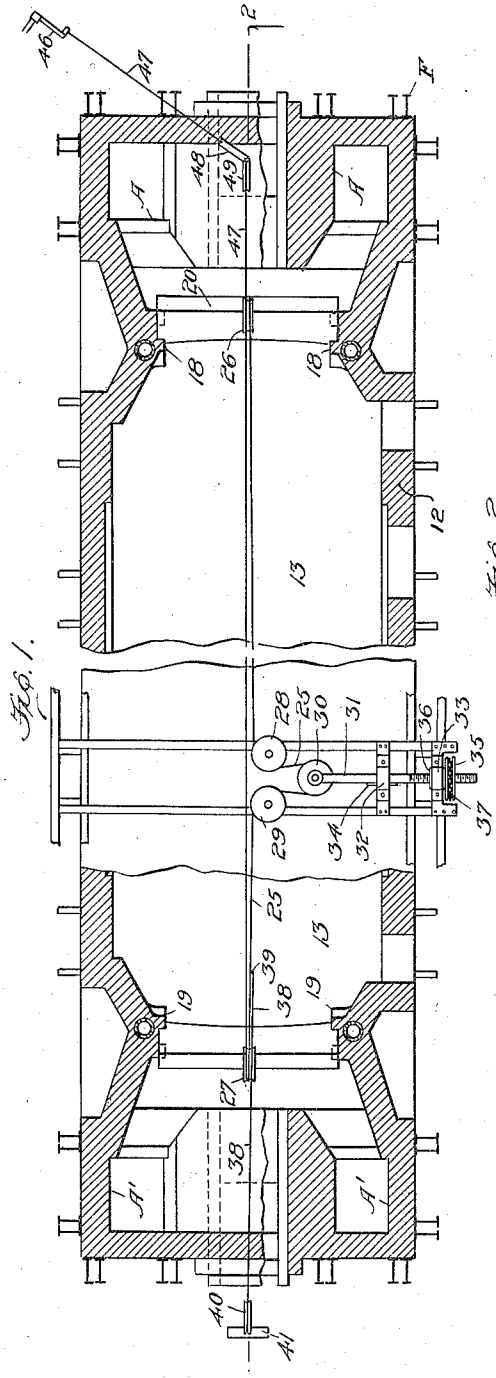

Fig. 1.

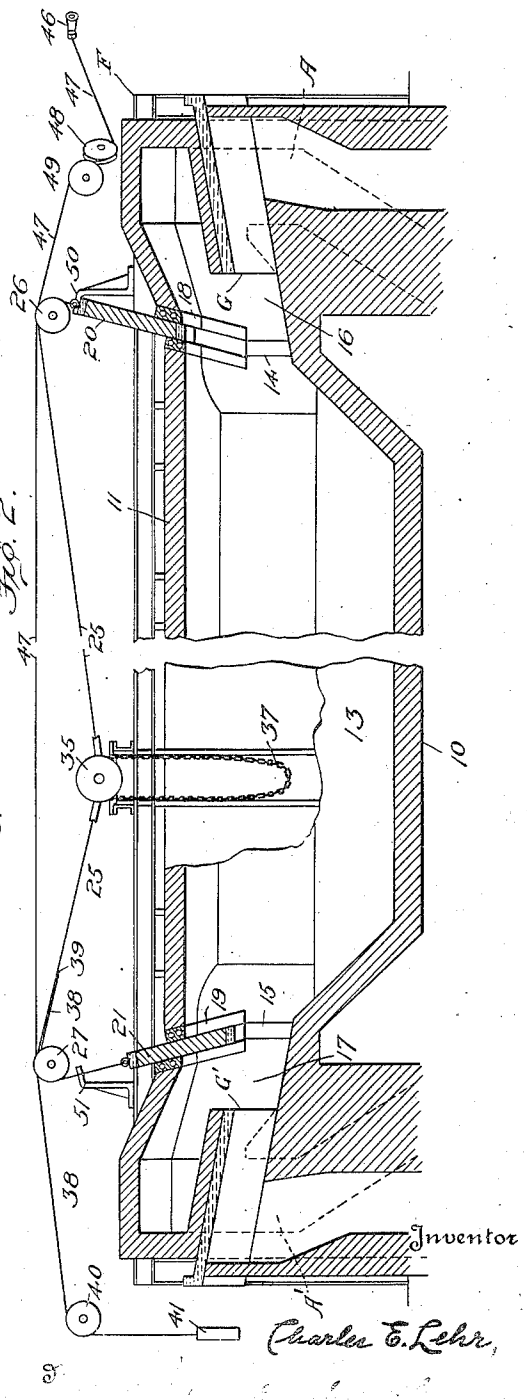

Fig. 2.

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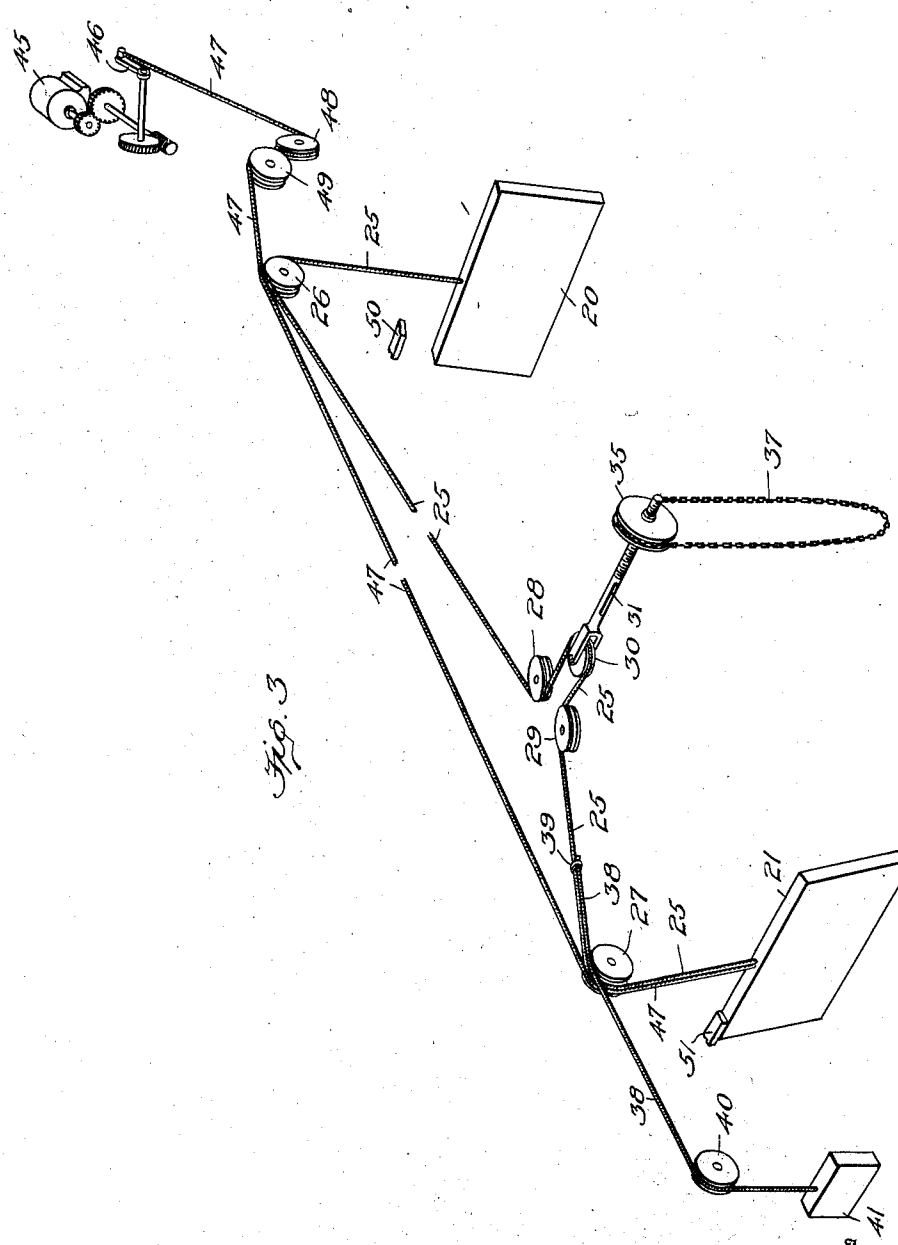

Fig. 3

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UNITED STATES PATENT OFFICE.

CHARLES E. LEHR, OF BETHLEHEM, PENNSYLVANIA, ASSIGNOR TO BETHLEHEM STEEL COMPANY, A CORPORATION OF PENNSYLVANIA.

DEVICE FOR OPERATING OPEN-HEARTH-FURNACE DAMPERS.

Application filed October 21, 1922. Serial No. 596,020.

To all whom it may concern:

Be it known that I, CHARLES E. LEHR, a citizen of the United States, and residing at Bethlehem, Lehigh County, State of Pennsylvania, have invented certain new and useful Improvements in Devices for Operating Open-Hearth-Furnace Dampers, of which the following is a specification.

The present invention relates to regenerative furnaces and particularly to furnaces of this class designed and constructed for use in the production of steel by the open hearth process.

In the patent to Aubert 1,304,725 granted May 27, 1919 a furnace is illustrated and described which is provided with means for varying the effective areas of the furnace ports at the ends of the furnace so that the incoming fuel may be introduced through a relatively restricted inlet orifice and the outgoing products of combustion may be allowed to escape through an orifice of considerably larger size. The furnace is reversible and the port area regulating means may be operated so that either end of the furnace may be the inlet end and either end the outlet end. In a furnace of this character it is permissible to introduce high velocity gases, thus increasing the speed of melting of the charge and the production of the furnace, without at the same time decreasing the effective life of the furnace, since the outgoing products of combustion will pass from the furnace at moderate velocity, due to the greatly enlarged area of the furnace outlet port. The port restricting means at the ends of the furnaces are, in accordance with the Aubert invention, regulated individually by hand.

The object of the present invention is to provide, in connection with a furnace having port restricting means of the general character described in the Aubert patent, means for effecting the operation of the port restricting means at the opposite ends of the furnace simultaneously upon a reversal of the furnace. The invention will be disclosed as incorporated with the furnace illustrated, described and claimed in application Serial No. 559,381, filed May 8, 1922, by R. S. A. Dougherty which furnace is of the Aubert type, but in which the port restricting means comprises a damper at each end of the furnace positioned between the combustion chamber and the ports leading to the regenerators, which damper may be moved into or out of the throat or conduit connecting the combustion chamber and regenerator ports through a slot or aperture in the furnace roof. The invention may be applied, however, to other furnaces embodying the principle of the Aubert invention to effect the simultaneous operation of the dampers, as will be seen by those skilled in the art. An important feature of the invention consists in the provisions of means whereby the adjustment of one damper may be effected, while the furnace is in operation, without adjusting the other, this means being conveniently and manually operable by the furnace attendant. The effective area of the inlet conduit may be varied by this means without varying the effective area of the outlet conduit. Other novel features of the invention will be apparent from the disclosure thereof in the following description and in the accompanying drawings, in which:

Fig. 1 is a top view, partly in plan and partly broken away, of a furnace of the type indicated having the invention incorporated therewith;

Fig. 2 is a section on line 2—2 of Figure 1; and

Fig. 3 is a perspective view of the port area controlling means.

The furnace comprises essentially a hearth 10 and roof 11 which enclose, together with the side walls 12, a combustion space 13 in which the gases are burned. Furnace ports 14 and 15 are located at the ends of the furnace, each of these ports being adapted to serve as an inlet port for fuel or as an outlet port for products of combustion. Conduits 16 and 17 connect the respective furnace ports with the regenerator ports A, A′ and G, G′ respectively at the ends of the furnace. The air is discharged into the conduits 16 and 17 from the ports A and A′ alternately and gas is discharged from ports G and G′ alternately.

Slots 18 and 19 are provided in the roof 11 and dampers 20 and 21 are positioned to be inserted through said slots into the conduits connecting the furnace ports with the regenerator ports, for the purpose of varying the effective area of these conduits. The dampers are preferably downwardly and inwardly inclined as shown and are guided in trackways 22 and 23 in the side walls of

the furnace. The side walls may have reentrant portions as shown in Figure 1 which constitute the well known "monkey walls".

The frame of the furnace, comprising the usual beams and buck stays, is indicated at F and supported on this frame is the means for effecting the operation and adjustment of the dampers. The tops of the dampers are connected by a rope 25 which passes over pulleys 26 and 27 respectively at the ends of the furnace and pulleys 28, 29 and 30 at the middle. All of these pulleys are fixed with the exception of pulley 30 which may be adjusted transversely of the furnace to lengthen or shorten as desired, the effective length of the rope or cable 25. Pulley 30 is rotatably supported on the end of a shaft 31 which extends through brackets 32 and 33 respectively. Shaft 31 is provided with a keyway and a key 34 on bracket 32 extends into this keyway to prevent the shaft from rotating. The outer end of shaft 31 is threaded and has threaded engagement with an axial recess in the hub of wheel 35, which wheel is held against movement laterally of the furnace by any suitable means but is freely rotatable. A sleeve 36, rigidly secured to wheel 35, may extend through bearing 33 if desired, as shown in Figure 1, to hold the wheel 35 against axial movement, shaft 31 having threaded engagement with sleeve 36 as well as wheel 35. An endless chain 37 extends around and has frictional or positive engagement with wheel 35, and hangs downwardly to within reach of the furnace operator. It will be obvious that by rotating wheel 35 in one direction by means of the chain the effective length of cable 35 may be increased, or by rotating it in the other direction the effective length of this cable may be decreased.

A cable 38 is secured to cable 25 at 39, this cable extending over pulley 27 and over a pulley 40 at the end of the furnace, and having attached to its opposite end a weight 41. Weight 41 normally tends, therefore, to lower damper 21 to its lowest position of adjustment and to raise damper 20, as shown in Figure 2.

Power means is utilized to raise damper 21 and lower damper 20 and this means includes an electric motor 45 conveniently positioned adjacent the furnace. This motor operates, through suitable intermediate gearing, a crank arm 46 connected by means of a cable 47 with the damper 21, this rope passing over direction changing pulleys 48 and 49 and over pulleys 26 and 27. The pulley 26 is provided with two grooves in which the cables 25 and 47 are separately contained, and the pulley 27 is provided with three individual grooves for the cables 25, 38 and 47 respectively. The length of crank arm 46 is such that in rotating 180° the positions of the dampers may be completely reversed, and the motor 45 is under the control of the operator or may be connected for automatic operation with the main furnace reversing valves, which are not illustrated.

Stops are provided for limiting the upward movement of the dampers 20 and 21, these stops being indicated respectively at 50 and 51 and being rigidly supported from the frame of the furnace. It will be seen that by utilizing the above construction the dampers are not only to be quickly reversed in position when the furnace is reversed but the damper at the incoming end may be adjusted as desired, independently of the damper at the outgoing end. Such adjustment may be frequently desired in the operation of the furnace, because of variations in the pressures of the gas and air being supplied, the composition of the gas, and other practical considerations. To effect the vertical adjustment of damper 21 for instance (see Fig. 2), it is only necessary for the attendant to manipulate chain 37 to either raise or lower the same. If he shortens the effective length of cable 25 damper 21 will be raised. If he lengthens cable 25 it will be lowered, and movement of the damper 20 is prevented in the meanwhile since this damper is tightly held against its stop 50 by the weight 41. This is a permanent adjustment and when damper 20 is lowered and damper 21 raised, upon reversal of the furnace, damper 20 will be positioned within the furnace exactly as damper 21 had been positioned at the opposite end, the length of cable 25 being unchanged by the reversal.

To one skilled in the art the advantages of this invention will be apparent and it will also be obvious that the design and arrangement of the damper operating means may be considerably varied without departing from the scope of the invention.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. Mechanism of the class described including in combination, a reversible furnace having a combustion chamber and a conduit at each end for the passage of incoming fuel or outgoing products of combustion, a device associated with each conduit for decreasing its gas carrying capacity when used as an inlet conduit for fuel and increasing its gas carrying capacity when used as an outlet conduit for products of combustion, and means connecting said devices for simultaneous operation, said means permitting adjustment of one of said devices without adjustment of the other.

2. Mechanism of the class described including in combination, a reversible furnace having a combustion chamber and a conduit at each end for the passage of incoming fuel or outgoing products of com-

bustion, a device associated with each conduit for decreasing its gas carrying capacity when used as an inlet conduit for fuel and increasing its gas carrying capacity when used as an outlet conduit for products of combustion, means connecting said devices for simultaneous operation, a power element for operating said means, and said means including a manually operable member for adjusting one of said devices without adjusting the other.

3. Mechanism of the class described including, in combination, a reversible furnace having a combustion chamber and a conduit at each end for the passage of incoming fuel or outgoing products of combustion, a device associated with each conduit for decreasing its gas carrying capacity when used as an inlet conduit for fuel and increasing its gas carrying capacity when used as an outlet conduit for products of combustion, means connecting said devices for simultaneous operation, a power element for operating said means in one direction, and a weight for operating said means in the opposite direction.

4. An open hearth furnace having ports at its ends for fuel and products of combustion, a damper movable transversely of each of said ports for varying its effective area, and means connecting said dampers together for simultaneous movement upon reversal of the furnace, said means being designed and constructed to permit one of said dampers to be adjusted while the other is stationary.

5. An open hearth furnace having ports at its ends for fuel and products of combustion, a damper movable transversely of each of said ports for varying its effective area, a cable connecting said dampers whereby they may be simultaneously operated when the furnace is reversed, and means for adjusting the effective length of the cable.

6. An open hearth furnace having ports at its ends for fuel and products of combustion, a vertically movable damper movable transversely of each of said ports for varying its effective area, a cable connecting said dampers whereby they may be simultaneously operated when the furnace is reversed, and means for adjusting the effective length of the cable.

7. An open hearth furnace having ports at its ends for fuel and products of combustion, a damper movable transversely of each of said ports for varying its effective area, a cable connecting said dampers whereby they may be simultaneously operated when the furnace is reversed, and means for adjusting the effective length of the cable, said means including a pulley engaging the cable and mechanism for moving the pulley in a direction transverse to the general direction of the rope.

8. An open hearth furnace having ports at its ends for fuel and products of combustion, a damper movable transversely of each of said ports for varying its effective area, a cable connecting said dampers whereby they may be simultaneously operated when the furnace is reversed, and means for adjusting the effective length of the cable, said means including a pulley engaging the cable and screw means for moving the pulley in a direction transverse to the general direction of the cable.

9. An open hearth furnace having ports at its ends for fuel and products of combustion, a vertically movable damper movable transversely of each of said ports for varying the effective area, a stop limiting the upward movement of each damper, a cable connecting said dampers whereby they may be simultaneously operated when the furnace is reversed, and means for adjusting the effective length of the cable.

10. An open hearth furnace having ports at its ends for fuel and products of combustion, a damper substantially vertically movable transversely of each of said ports for varying its effective area, a cable connecting said dampers whereby they may be simultaneously operated when the furnace is reversed, means normally tending to lower one of said dampers and to raise the other, and power means for moving the dampers in the opposite direction.

In testimony whereof I hereunto affix my signature.

CHARLES E. LEHR.