Oct. 4, 1949. O. F. ECKLUND 2,483,968

FURNACE DOOR AND CLOSURE OPERATOR THEREFOR

Filed May 11, 1945 2 Sheets-Sheet 1

Fig. 1

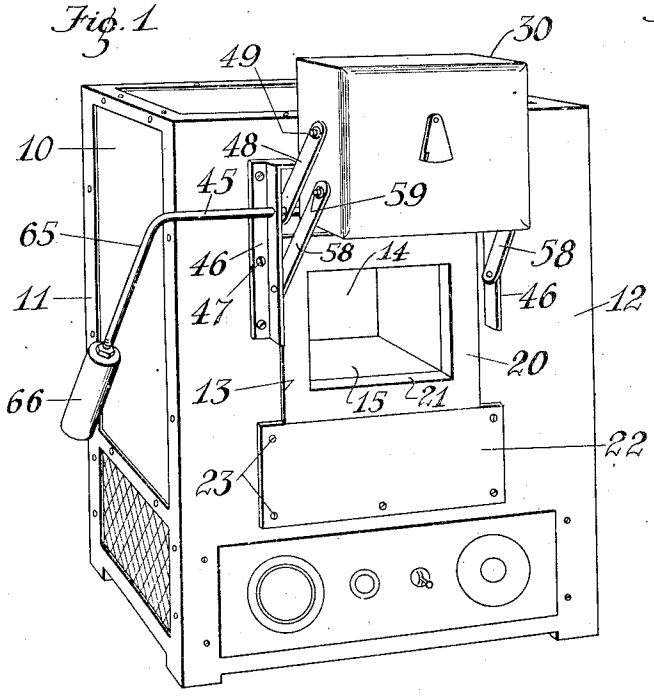


Fig. 4

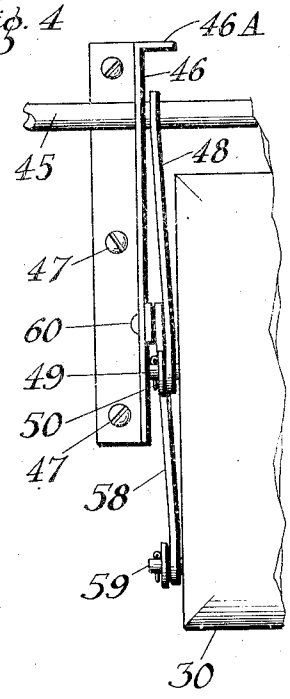


Fig. 2

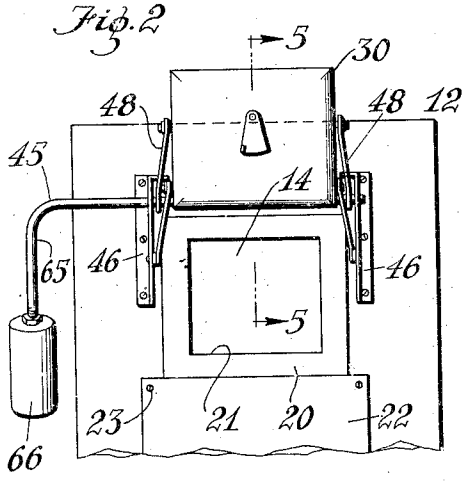
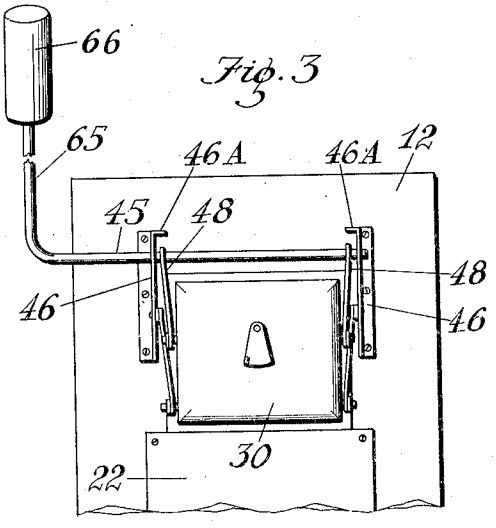


Fig. 3



INVENTOR.
Oscar F. Ecklund
BY Wallace and Cannon
Attorneys

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Fig. 5

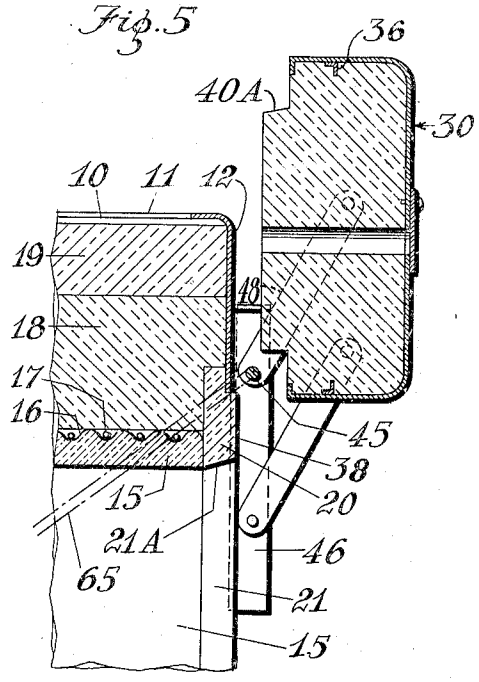

Fig. 6

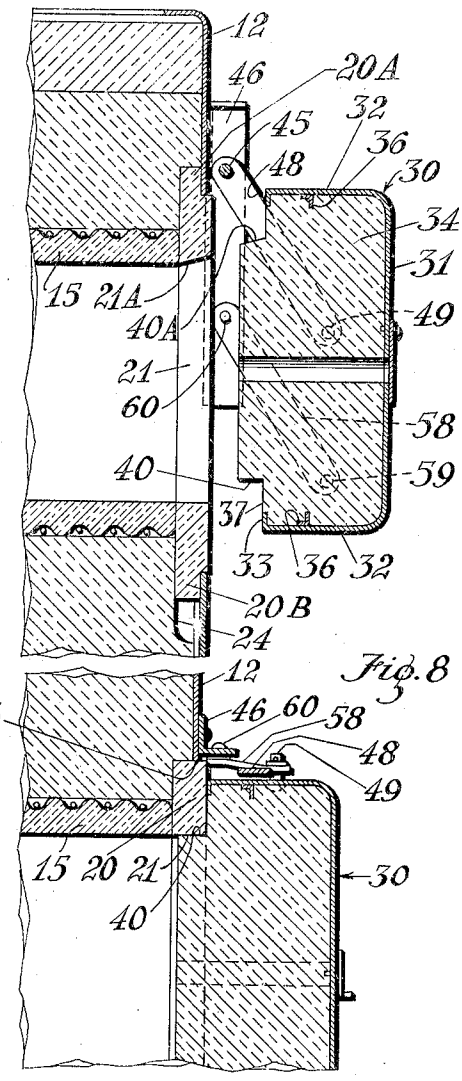

Fig. 7

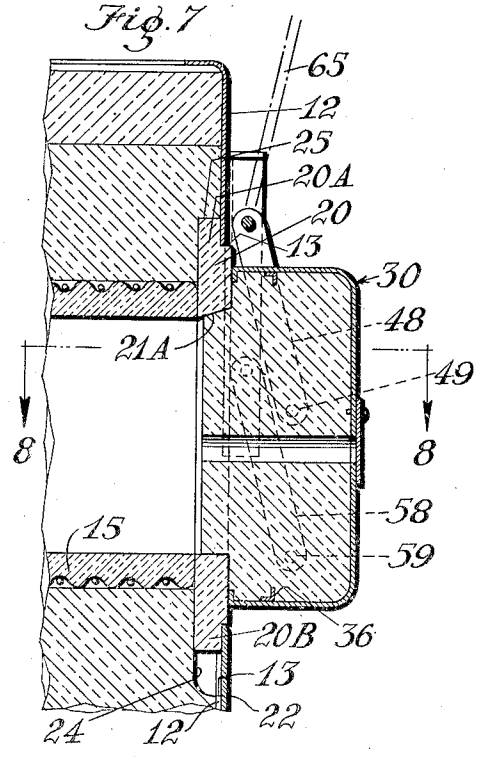

Fig. 8

INVENTOR.
Oscar F. Ecklund
BY
Wallace and Cannon
Attorneys

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FURNACE DOOR AND CLOSURE OPERATOR THEREFOR

Oscar F. Ecklund, Broadview, Ill., assignor to Thermo Electric Manufacturing Company, Dubuque, Iowa, a corporation of Illinois

Application May 11, 1945, Serial No. 593,216

2 Claims. (Cl. 110—176)

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This invention relates to heating furnaces and particularly to the manner of supporting the door on such a furnace.

In heating furnaces, such for example as electric furnaces used for metal working shops and laboratories, it has been customary to mount the relatively heavy insulated door of such a furnace either on hinges or in a sliding mounting for movement between open and closed positions. When the door of such a furnace has been mounted in the manner heretofore employed, the door when in its open position has been so located as to hamper the workmen in removing the heating objects from the furnace, and to enable the door on such a furnace to be readily moved to an out-of-the-way position is the primary object of the present invention.

In furnaces as heretofore constructed, the door that has been associated therewith has been supported in such a way that proper sealing of the interior of the furnace has not been accomplished in most instances, and to enable the door opening of such a furnace to be properly sealed in a simple and effective manner is still another object of the present invention. Another object of the present invention is to support the door on an electric furnace or the like in such a manner that after it is moved into substantial registry with the door opening, the door may be moved in an endwise direction so as to effect a sliding fit between the door and the door opening, thereby to produce an extremely tight seal between the door and the door opening or frame.

Another object is to enable the door on an electric furnace or the like to be so supported that when the door is in its open position, the door frame may be readily removed, thereby to simplify the removal and replacement of the heating elements of the furnace.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show a preferred embodiment and the principle thereof and what I now consider to be the best mode in which I have contemplated applying that principle. Other embodiments of the invention embodying the same or equivalent principle may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

Fig. 1 is a perspective view of an electric furnace embodying the features of the invention;

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Fig. 2 is a fragmental front elevational view of the furnace showing the door in an open position;

Fig. 3 is a view similar to Fig. 2 and showing the door in its closed position;

Fig. 4 is a fragmental view showing a portion of Fig. 3 on an enlarged scale;

Fig. 5 is a fragmental vertical sectional view taken substantially along the line 5—5 of Fig. 2 and showing the door in its open position;

Fig. 6 is a view similar to Fig. 5 and showing the door after it has been moved part way toward the closed position thereof;

Fig. 7 is a view similar to Figs. 5 and 6 and showing the door after it has reached its closing position; and

Fig. 8 is a fragmental plan section taken substantially along the line 8—8 of Fig. 7.

For purposes of disclosure the invention has been herein illustrated as embodied in an electric furnace 10, but it will be recognized that the features of the invention may be utilized in furnaces employing a different type of heating means. The furnace 10 has an angle iron frame 11, and the forward face of the frame 11 is covered by a relatively heavy metal wall 12 having an opening 13 formed therein through which access may be had to the heating chamber 14 of the furnace. The heating chamber 14 has the bottom, top and side walls formed from a muffle core 15 made from ceramic material and of hollow substantially rectangular form, and the exterior surface of the muffle 15 has a spiral groove 16 formed therein that serves as a mounting for an electric heating wire 17 that is wound about the walls of the muffle 15 within the groove 16. The muffle 15 is supported by the walls of the furnace 10, such walls being formed from inner and outer layers 18 and 19 of insulating material, Fig. 5, that is supported in the frame 11. The insulating material 18 serves of course to form the inner end of the heating chamber, or in other words, serves to close the rear end of the muffle 15. After the muffle 15 is put in position, a hearth collar or frame 20 is put into position at the forward or outer end of the muffle 15. This frame 20 has a central opening 21 formed therein that is in the present case arranged so as to form a substantial continuation of the inner surfaces of the muffle 15. The frame 20 is of such a width in a horizontal direction that it will slide inwardly through the opening 13, as will be evident in Fig. 8 of the drawings, and at its upper and lower edges, the frame 20 has flanges 20A and 20B respectively that are utilized in securing the

frame 20 in position. Thus when the frame 20 is to be mounted in or removed from its operative position, a retaining plate 22 that is disposed beneath the frame 20 is removed, this frame 22 being secured in position by means such as screws 23. The opening 13, as will be evident in Figs. 6 and 7 of the drawings, is extended downwardly for such a distance that when the plate 22 is removed, a clearance space 24 formed in the insulating material 18 is exposed. Thus after the plate 22 has been removed, the frame 20 may have the upper edge thereof moved through the upper portion of the opening 13, after which the upper flange 20A may be slid into position inside of the wall 12, there being a clearance space 25 in the insulating material 18 to enable this to be accomplished. After the frame 20 has been moved upwardly, the lower edge of the frame may be moved into the position shown in Fig. 7 and the retaining plate 22 may be secured in place so as to engage the outer face of the lower flange 20B. This serves to hold the frame 20 in position with the opening 21 thereof in alignment with the inner surfaces of the muffle core 15.

In accordance with the present invention, the door opening 21 may be closed by a shiftable door 30 that is adapted to be moved from an open out-of-the-way position shown in Figs. 1, 2 and 5 to a closed position shown in Figs. 3, 4 and 7. The door 30 is formed from an outer metallic shell having a front wall 31 and top, bottom and side walls 32 that are formed integrally therewith. The top, bottom and side walls 32 are flanged inwardly as at 33 so as to retain a ceramic filler 34 in position within the metallic cover 31. In some instances this retaining action may also be supplemented by anchor strips in the form of angle bars 36 secured to one or more of the side, bottom and top walls 32 so as to project inwardly into the ceramic filler 34. The inner face of the ceramic filler 34 is formed to afford a flat face 37 adapted to engage the outer flat surface 38, Fig. 5, of the frame 20 when the door 30 is in its closed position, the face 37 of the door 30 being formed in the plane of the outer surface of the flange 33. The surface 37 is arranged to border a projecting sealing portion 40 of the door 30, the portion 40 being formed as an integral part of the ceramic filler 34 and being so shaped as to be complemental to the door opening 21 of the frame 20. Thus when the door 30 is to be closed, it is first moved into substantial alignment with the opening 21 of the frame 20 and is then moved directly toward the frame 20 so as to slide the sealing portion 40 of the door into the door opening 21 in tightly sealed relation. In attaining this action the upper face of the opening 21 is disposed in an angular relation as at 21A, Figs. 5 to 7, while the upper surface of the sealing portion 40 is disposed at an angle as at 40A that is complemental to the surface 21A.

In accordance with the present invention, the door 30 is so mounted and supported that such movement of the door 30 into and out of its closed position may readily be effected, and in accomplishing this result the door 30 is supported so that when the opening movement of the door 30 is continued, the door is moved to the out-of-the-way open position shown in Figs. 1, 2 and 5. Thus, an actuating shaft 45 is mounted for rocking movement in a pair of spaced vertically extending brackets 46, such brackets being formed from angle iron so that when one flange is secured as by screws 47, to the front plate 12, the other flange projects outwardly from the front plate. The brackets 46 are disposed in vertically extending positions on opposite sides of the opening 13 of the front plate 12, and the shaft 45 is mounted in the brackets 46 in a horizontal position just above the upper edge of the opening 13. An actuating and supporting connection from the rock shaft 45 to the door 30 is afforded by a pair of links or arms 48 that are fixed on the shaft 45 as by brazing so as to extend radially from the shaft in a common radial plane. The arms 48 are disposed on the shaft 45 in such a spaced relation that the free ends thereof are disposed opposite and relatively close to the vertical side faces or flanges 32 of the door 30, and pivot studs 49 extended from the flanges 32 project through aligned openings formed in the arms 48 adjacent the ends thereof. The arms 48 are held in position on the studs 49 by means such as cotter pins 50, and thus the door 30 is pivotally suspended on the ends of the arms 48 so that the door 30 may be moved or shifted by rocking movement of the rock shaft 45. In such movements of the door 30, the arms 48 cooperate with links 58 to guide the door 30 into and out of the desired closed and sealed relationship with respect to the frame 20. Thus horizontal pivot studs 59 are provided in aligned relationship on the opposite vertically disposed flanges 32 of the door 30, these studs 59 being spaced a substantial distance downwardly from and in the same vertical plane as the pivot studs 49. The links 58 are of the same length as the links or arms 48, and the other ends of the links 58 are pivoted on aligned studs 60 passed through the brackets 46. The studs 60 are disposed in the same vertical plane as the rock shaft 45, and the spacing between the shaft 45 and the studs 60 is the same as the vertical spacing between the studs 49 and 59. Thus the door 30 is supported and guided by a parallelogram linkage, and may be moved between open and closed positions by rocking movement of the rock shaft 45. In order that such door operating movements may be readily accomplished, the shaft 45 is extended to the left, Figs. 1 to 3, to a point beyond the left hand side of the frame 11, and is bent laterally to afford an operating arm 65.

The operating handle 65 also serves as a part of a counterweight means that acts to hold the door 30 in either its open or closed position, and for this purpose the arm or handle 65 has a weight 66 secured on the end thereof. The arm 65 and the weight 66 are so related to the angular position of the arms 48 on the shaft 45 that when the door 30 is in its open position, the arm 65 will be disposed in a rearwardly projecting relationship with respect to the shaft 45. Thus the weight 66 is effective to hold the shaft 45 in its most counterclockwise position of Fig. 5 so that the door 30 is in open position. In the opening movement of the door 30 the parts are protected against damage by stop means effective upon the links 48 to limit opening movement of the door, and as herein shown such stop means are afforded by inwardly turned upper ends 46A of the brackets 46, such ends or lugs being disposed in the path of the arms 48, as shown in Figs. 2, 3 and 4. When the door is to be closed, the arm 65 is moved in a clockwise direction from the position of Fig. 5 to the position of Fig. 7, and when this movement is completed the weight 66 is disposed forwardly of the shaft 45 so as to apply door-closing force to the rock shaft 45.

With the door **30** supported and actuated in the manner just described an exceptional seal may be attained between the door **30** and the frame **20**, as will be evident from a consideration of Figs. 5 to 8 of the drawings. Thus when the closing movement of the door **30** is started, the door moves from the out-of-the-way position of Fig. 5 to the position of Fig. 6 wherein the sealing portion **40** of the door is substantially aligned with the door opening **21** of the frame **20**. Continued downward movement of the door causes the sealing portion **40** to move into the door opening **21**, it being noted that the upper border of the door opening **21** is tapered or sloped as indicated at **21A**, while the upper surface of the portion **40** has a complemental slope as indicated at **40A**. Thus, adequate clearance is provided to enable entry of the sealing portion **40** into the door opening **21**, and as the closing movement of the door progresses, the surface **40A** will engage the surface **21A** at the same time that the lower surface of the portion **40** engages the lower surface that defines the opening **20**. Moreover, such engagement of the surfaces **40A** and **21A** takes place at the same time that the face **38** of the door frame **20** is engaged by the flat surface **37** of the door **30**, and hence an efficient seal is afforded about all of the edges of the door **30**, it being noted that the side surfaces of the portion **40** are in sliding engagement with the vertical surfaces that define the slides of the opening **21**, as shown in Fig. 8.

The efficient seal that is thus afforded around the door **30** when it is in its closed position is maintained by the action of the weight **66**, and in this connection it should be observed that the studs **49** through which closing forces are applied to the door **30** are located substantially half way between the upper and lower edges of the door **30**, and hence the door closing forces applied in a generally horizontal direction, and to the left in Fig. 7, are substantially evenly distributed so as to attain a uniform and effective sealing relationship entirely about the edges of the door **30**.

From the foregoing description it will be evident that the present invention materially simplifies and improves the construction and operation of heating furnaces, and particularly it will be apparent that the manner in which the door is associated with the other elements of the furnace insures proper and economical operation of the furnace and serves as well to simplify the upkeep or repair of the furnace. The movements of the door in the furnace of the present invention are so guided and related to the door frame that effective sealing of the door is insured in a simple and economical manner.

Thus, while I have illustrated and described the preferred embodiment of my invention, it is to be understood that this is capable of variation and modification and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims:

I claim:

1. In a furnace including a substantially vertical wall having an access opening therein, a door for closing the same and door operating means comprising parallel elongated vertically disposed brackets secured to opposite sides of the opening and projecting outwardly from the plane of the wall, a combined actuating shaft, door operator and counterweight supporting arm including a rock shaft portion, and an outer operating portion disposed at substantial right angles thereto and having a counterweight secured thereon, said brackets having horizontally aligned apertures therein above the door for journalling said rock shaft portion of the arm, spaced actuating links fixedly secured to the rock shaft between the brackets and projecting radially outwardly therefrom in an extension of a plane including the outer operating portion of the arm and the counterweight and on the opposite side of the actuating shaft from said counterweight and pivotally connected to the side edges of the door, guide links respectively pivotally secured at one end to the said brackets in spaced vertical alignment with the rock shaft and at the other end of the side faces of the door in spaced vertical alignment with the pivotal connection of said actuating links, the said links constituting a parallelogram linkage so that when the door is in its open position the links are in substantial parallelism with one another and inclined upwardly and outwardly with respect to the plane of the wall of the furnace and the counterweight and operating portion of the arm is inclined downwardly and to the rear of the plane of the wall with the counterweighted portion disposed adjacent the side of the furnace and beneath the axis of the rock shaft, and when the door is in its closed position the said links are in substantial parallelism with one another and extend at an inclination downwardly and outwardly with respect to the plane of the wall with the counterweighted portion of the arm being inclined upwardly and outwardly of the axis of the rock shaft so that the counterweighted portion effectively maintains the door in both its open and closed positions.

2. A furnace as defined in and by claim 1, wherein the brackets extend upwardly above the door toward the top of the furnace and are provided with transversely disposed lugs at the top thereof extending inwardly toward one another and being disposed in the arc of movement described by the actuating links and affording stop means to prevent the door striking the face of the furnace above the opening.

OSCAR F. ECKLUND.

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