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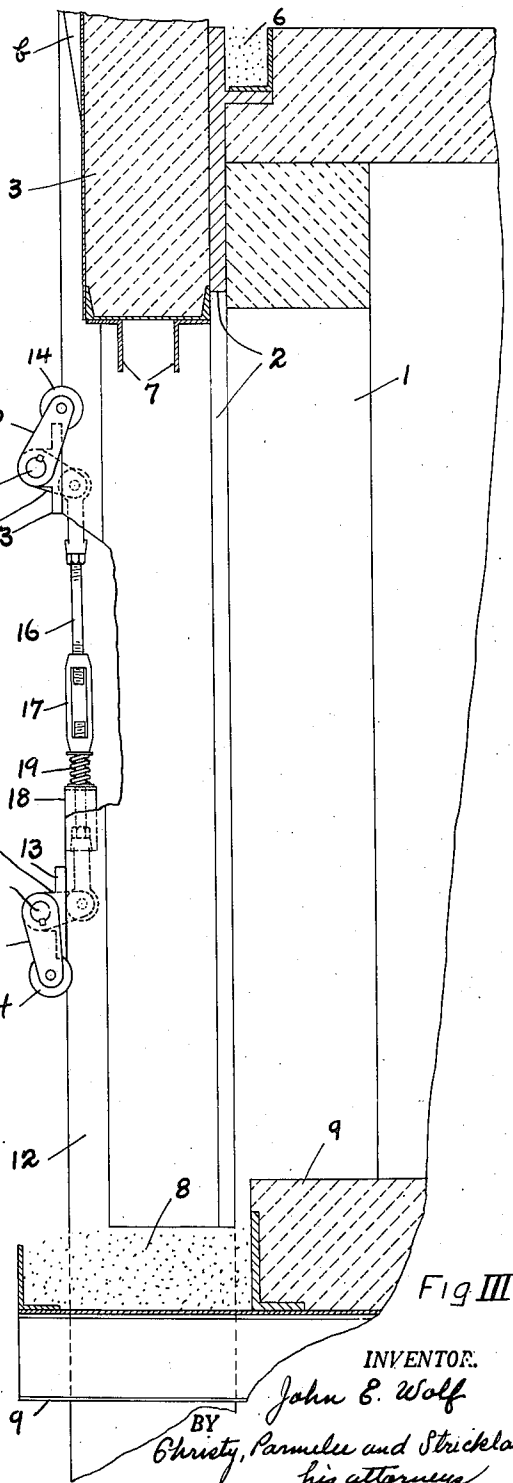


Fig. III

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DOOR MECHANISM

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7 Claims. (Cl. 110—176)

This invention relates to doors, particularly, though not exclusively, to sliding doors of the type found on certain industrial furnaces, such as car-bottom furnaces used in the annealing of metal castings, or other material to be heat treated.

The charge-supporting hearth of the conventional car-bottom furnace is formed by the refractory floor of a car that is adapted to travel on rails through the furnace doorway, between service position within the furnace and loading and unloading position without the furnace. When the furnace is in operation the door engages at its upper edge a sand seal included in the furnace structure above the furnace doorway; at its lower edge the door engages a sand seal embodied in the car structure; and at the two sides of the doorway the door bears upon a cheek plate mounted on the front wall of the furnace and extending across the top and down the two sides of the doorway. The door is movable vertically between open and closed positions, and of course it is desirable that the door, when in closed position, shall be hermetically tight upon the doorway. When the door is closed and opened no difficulty is encountered in establishing and interrupting the engagement of the door with the said seals, but the same does not hold true for the engagement of the door with the cheek plate. Under the effects of the wear and heat to which the door is in service exposed, it is difficult, if not impossible, to maintain a snug sliding engagement of the edges of the door upon the cheek plate, and for this reason furnace builders have tried various devices for clamping the door to the cheek plate. The clamping devices hitherto in use are manually released when it is desired to open the door, and manually locked again when the door is closed.

The door clamping mechanism of my invention operates automatically. When the door is lowered into closed position the mechanism locks itself, clamping the door with equalized pressure to the engaged areas of the cheek plate. Alternately, when the door is raised, the mechanism moves automatically into release position. It is to be understood that the capacity of the mechanism to equalize the pressure of engagement of the door over the entire engaged area of the cheek plate is a feature of notable value.

In the accompanying drawings Fig. I is a fragmentary view in front elevation of a furnace door equipped with a clamping mechanism embodying the invention;

Fig. II is a vertical sectional view of the same on the plane II—II of Fig. I;

And Fig. III is a sectional view, on the same plane as Fig. II, showing the furnace door fragmentarily in open position, whereas in Fig. II the door is shown in closed position.

Referring to the drawings, the reference numeral 1 indicates the doorway in the front wall of a car-bottom furnace, and 2 indicates the cheek-plate which, secured upon the front wall of the furnace, extends across the top and down the two sides of the doorway. The furnace door 3, comprising a fabricated metal shell lined with refractory material, when in closed position, seats upon said cheek-plate at the two sides and top of the doorway.

The door is movable vertically between closed position, Fig. II, and open position, Fig. III. The means for opening and closing the door form no part of the present invention, and accordingly are not shown in the drawings. Extending along the upper edge of the door is a member 4 that is provided with a blade portion 5 which, when the door is lowered from open to closed position, embeds itself in usual way in a sand seal 6 carried by the front wall of the furnace, while the lower edge of the door carries two blades 7 that lodge in a sand seal 8 provided in known way in the body of the car, which is fragmentarily indicated at 9. As thus arranged the door is intended to provide a substantially hermetic closure for the doorway of the furnace, but, as above mentioned, under the conditions of service the door normally does not seat tightly against the cheek-plate.

The means of this invention for seating the door tightly in closed position in the doorway, that is, upon the cheek-plate 2 in this case, comprise two sets of cam members *a*, *b* and *a*, *b*. The two sets of cam members are spaced apart horizontally, and the two cam members *a* and *b* in each set are aligned and spaced apart vertically. Means cooperate with said cam members, when the door is closed, to secure the door in tightly seated position of closure, and such means include an arm 10 for each cam member. The arms 10 are pivotally mounted on a rigid supporting structure. The supporting structure may conveniently consist, as herein shown, in the steel buckstays 12 of the furnace framework. The buckstays support bearing blocks 13 in which shafts 11 are journaled. The distal ends of the arms 10 are adapted to be engaged by their associate cam members, and preferably the engagement is anti-frictional, rollers 14 being mounted in the arms for this purpose. In Figs.

II and III it will be seen that the cam members have faces that slope upwardly and outwardly with respect to the outer face of the door, whereby when the door is lowered into closed position the rollers 14 are engaged by the sloping faces of the cam members with wedging effect. Outward rotation of the pivoted arms 10—rotation in a direction that moves the roller-equipped ends of the arms away from the face of the door—being limited, as it is by means presently to be described, the wedging action of the cam members *a*, *b* upon the arms is effective to press the door into tightly seated position against the cheek-plate 2. The door-seating cooperation between the cam members *a*, *b* and arms 10 is progressive as the descending door approaches its lowermost or closed position, and as the blades 5 and 7 enter the sand in the sand seals. By virtue of such feature the effect of the sand in resisting the slight but essential movement of the door towards the cheek-plate is minimized, and of substantially less effect than it would be if the door were fully closed and the blades fully embedded in the sand before the door-seating pressure was applied. When the door is raised into open position, the cam members move upwardly from engagement with the roller-equipped arms 10, and it will be understood that in neither the opening nor the closing of the door is there need for any manipulation of the door-seating or clamping mechanism. The operation is automatic.

The means for limiting the outward rotation of the arms 10, under the effect of the cam members on the door descending into closed position, comprise arms 15 severally secured to the shafts 11. While each arm 15 is spaced from the arm 10 on the shaft to which both arms are secured, the two arms are in mechanical effect integral, and extend angularly to each other, as is shown to best advantage in Figs. II and III. Each pair of arms 10, 15, thus organized, comprises in effect a bell-crank lever. The two arms 15 of the pair of levers in each vertically aligned set are pivotally interconnected by a tension rod 16, whose length is adjustable by means of a turnbuckle 17. Manifestly, when the door is lowered into closed position, the pressure exerted by the upper bell-crank lever of each pair or set is transmitted to the rod 16, and so is the pressure of the lower cam member on the arm 10 of the lower bell-crank lever. Thus, the pressure on the cam members *a*, *b* on the arms 10 of the two levers in each vertically aligned pair of levers is equalized, and the door is caused to bear with uniform pressure on all of the area of contact of the door with the cheek-plate 2.

The tension rods 16 also serve to limit the outward turning (a counterclockwise turning as seen in Figs. II and III) of the bell-crank levers 10, 15 under the effect of the cam members *a*, *b* when the door is lowered into closed position. It will be noted that the arm 10 of the lower bell-crank lever extends downwardly from the axis 11 on which it turns, while the arm 10 of the companion upper lever extends upwardly. When the door is closing and both levers are subject to the action of the cam members, the rod 16 restrains or limits the outward turning of the bell-crank levers, with the consequence that the cam members wedge against the rollers 14 and press the door into tightly seated position against the cheek-plates 2. The turnbuckle 17 in each of the bipartite rods 16 of the two sets of levers, providing for the adjustment of the effective

length of each rod, affords adjustment of the outer limit of swing of the arms 10.

When the door is fully raised, the mechanism remains in such position as to cooperate with the cam members *a*, *b* when the door is again lowered. The means for holding the disengaged mechanism in such position comprise brackets 18 welded to the buckstays 12 adjacent to which the rods 16 are located, and a spring 19 on each rod between the turnbuckle and the bracket 18 through which the rod extends; cf. Figs. I and III. As the door is lowered, the two lower cam members *b* on the door engage and swing the arms 10 of the upper levers outward beyond the normal limit of their movement, there being at that time no restraint against the rise of the rods 16 and the free turning of the lower arms 10. The lower cam members on the descending door thus engage and pass downwardly from engagement with the upper bell-crank levers, and presently enter engagement with the lower bell-crank levers, at which time the upper cam members *a* on the door severally engage the rollers 14 of the upper levers. All of the levers are now engaged by cam members, and none of the levers can swing outward beyond the limit described, the rod 16 tying the two levers of each pair or set together, so that one lever in a set cannot move without the other. Thus, as the door reaches closed position, the rollers 14 on the upper and lower levers provide fixed abutments against which the cam members bear with wedging effect, and so press the door into tightly seated position against the cheek-plate 2.

Within the terms of the appended claims various modifications are permissible. It will be understood that in the claims the terms "upward" and "outward" are intended to define the arrangement of the cam surfaces of the members *a* and *b* for a door that is raised into open position. If the door be one which is lowered into open position, the cam surfaces will extend outward and downward with respect to the plane of the door, while if the door opens sidewise, the cam surfaces will extend outward and laterally of the door. The quoted words will be understood to embrace these variations. In the same manner, the words "clockwise" and "counterclockwise," are intended as words of relationship and not limitation.

I claim as my invention:

1. A furnace including a doorway and a furnace door movable substantially in the plane of the door between open and closed positions, two cam members secured to the door in spaced-apart relation in the direction of door movement, said cam members including cam surfaces which slope toward the plane of the door in the direction of door movement towards closed position, a supporting structure, two members pivoted to said supporting structure in spaced-apart relation in the direction of door movement, with the space substantially equal to the space between said cam members, said pivoted members severally including cam-engaging portions extending laterally from the axes of their pivots and adapted to rotate on their pivots when, as the door moves into closed position, such portions are engaged by said cam surfaces, and means articulated to said pivoted members at points spaced laterally from the axes of the pivots and interconnecting the pivoted members to limit their rotation under the action of said cam surfaces, with the effect that when the door reaches

closed position, it is clamped with equalized pressure.

2. The structure of claim 1, said last means comprising a tension member of variable fixed length.

3. The structure of claim 1, said pivoted members comprising bell-crank levers, substantially as described.

4. The structure of claim 1, said pivoted members comprising bell-crank levers, and said interconnecting means comprising a tension rod of variable fixed length.

5. The structure of claim 1, said organization of cam members, pivoted members and interconnecting means being provided in two sets that are spaced apart transversely of the direction of door movement.

6. A furnace including a doorway and a furnace movable substantially in the plane of the door between open and closed positions, two cam members secured to the door in spaced-apart relation in the direction of door movement, said cam members including cam surfaces which slope toward the plane of the door in the direction of door movement toward closed position, a supporting structure, two members pivoted to said supporting structure in spaced-apart relation in the direction of door movement, with the space substantially equal to the space between said cam members, said pivoted members severally including cam-engaging portions extending from their pivots one in opposite direction rela-

tively to the other, said pivoted members being rotatable in opposite directions on their pivots when, as the door moves into closed position, said portions are engaged by said cam surfaces, and means articulated to said pivoted members at points spaced from the axes of the pivots and interconnecting the pivoted members to limit their rotation under the effect of said cam surfaces as the door closes.

7. A furnace including a doorway and a furnace door movable vertically between open and closed positions, two cam members secured to the doors in vertically spaced-apart relation, said cam members including surfaces that slope downward toward the plane in which the door is movable, a supporting structure, two members pivoted to said supporting structure in vertically spaced-apart relation, with the space substantially equal to the space between said cam members, said pivoted members severally including cam-engaging portions extending one upward and one downward from their pivots, said pivoted members being rotatable in opposite directions on their pivots when, as the door moves into closed position, said portions are engaged by said cam surfaces, and means articulated to said pivoted members at points spaced from their pivots and interconnecting the pivoted members to limit their rotation under the effect of said cam surfaces as the door closes.

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