March 29, 1960 H. W. BODEN 2,930,600

CAR BOTTOMED FURNACE

Filed April 19, 1957

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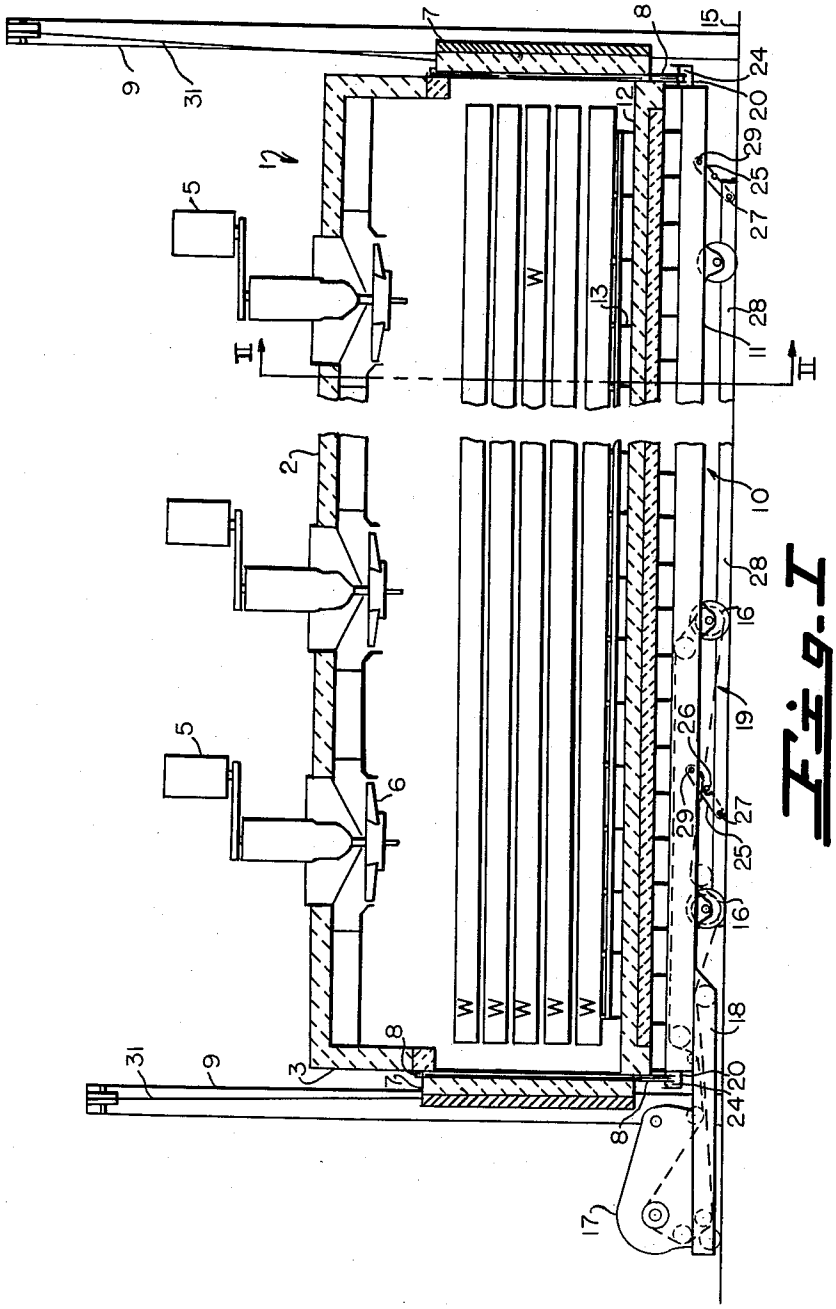

Fig. 1

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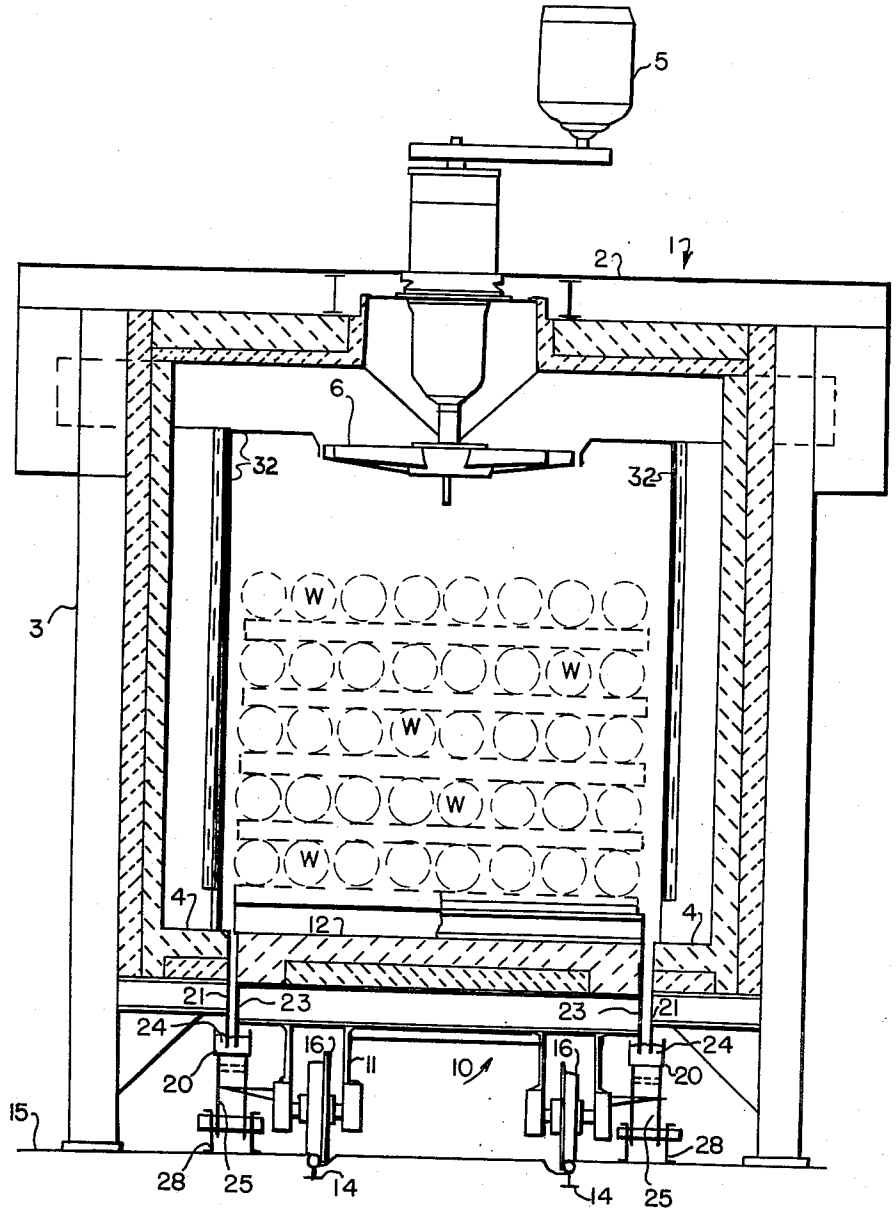

Fig. II

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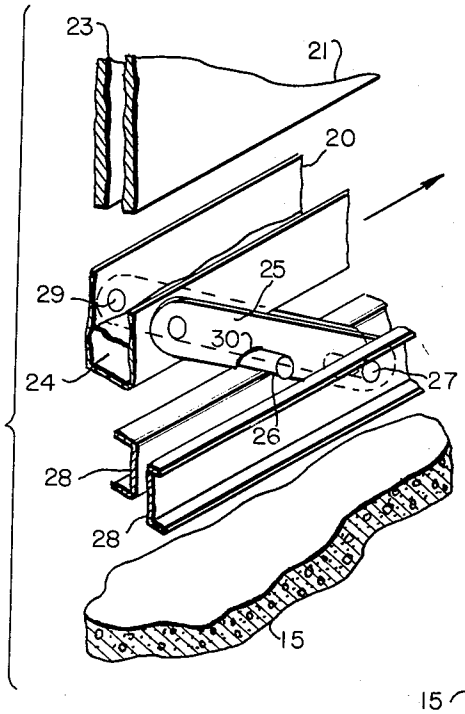

Fig. III

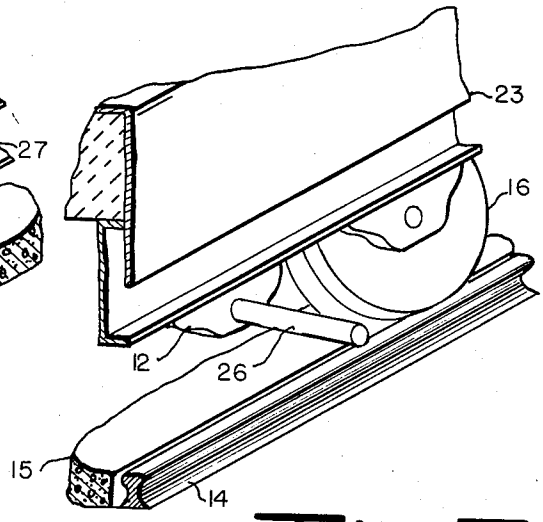

Fig. IV

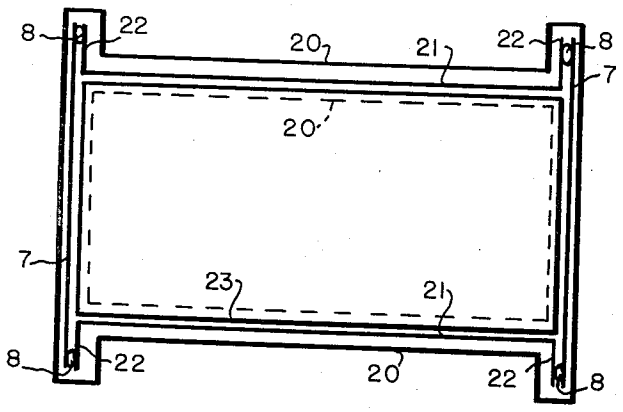

Fig. V

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CAR BOTTOMED FURNACE

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Application April 19, 1957, Serial No. 653,786

5 Claims. (Cl. 263—28)

This invention relates to furnaces and more particularly to annealing furnaces of the removable bottom type.

Furnaces of the type to which the removable furnace bottom of the invention are especially applicable are stationary annealing furnaces which have doors for taking work into and out of the furnaces in contrast to furnaces of the bell type which are lowered over work supporting bases and subsequently raised after the heat treating process has been completed. In such stationary annealing furnaces it is highly desirable, particularly where it is desired to have controlled atmosphere, to have gas-tight seals between the stationary walls of the furnaces and the removable furnace bottoms and especially to have gas-tight seals around the doors on the furnaces. Prior removable bottom type furnaces have not been provided with satisfactory gas-tight seals from the standpoint of the efficiency of the seals themselves and also from the standpoint of the ease of operation of the seals which, of course, must be broken when the furnace bottoms are removed.

It is, accordingly, the principal object of this invention to provide an improved removable bottom furnace.

Another object of the invention is to provide, in a removable bottom furnace, efficient and easily operable seals for preventing leakage of gas from the furnace.

More specific objects and advantages are apparent from the following description, in which reference is had to the accompanying drawings illustrating a preferred embodiment of the invention.

In the drawings:

Figure I is a longitudinal, fragmentary, vertical sectional view through an annealing furnace embodying the invention, showing the position of the various parts during an annealing cycle;

Figure II is a transverse, vertical sectional view taken along the line II—II of Figure I looking in the direction indicated by the arrows;

Figure III is an enlarged, fragmentary, perspective view of the gas-tight seal operating mechanism which is illustrated in Figures I and II;

Figure IV is a perspective view of one of the rod supports on the removable furnace bottom for the gas-tight seal operating mechanism which is shown in Figure III; and

Figure V is a schematic plan view of the gas-tight seal mechanism which completely encloses the removable furnace bottom.

These specific drawings and the specific description that follows merely disclose and illustrate the invention and are not intended to impose limitations upon the claims.

Referring to Figures I and II, the annealing furnace 1 includes a roof 2 that is supported by stationary side walls 3 which also support horizontal bottom ledges 4 that run the length of the furnace. The furnace bottom ledges 4 are spaced an appreciable distance apart so that the furnace is essentially bottomless. The furnace is heated by any suitable and well known means, not shown,

the heated gases being circulated by motor 5 operated fans 6 which also may function to circulate protective atmosphere within the furnace.

Access to the interior of the furnace is made through end doors 7 which have seals 8 around their upper and side edges and which are raised and lowered by means of ordinary hydraulic cylinder or motor operated door hoists 9. When a door 7 is raised, a removable furnace bottom 10 comprising a car 11 is moved into place between the stationary spaced furnace bottom ledges 4. By way of illustration, there is shown a charge of work W on the car 11 within the furnace 1 which is being heat treated. The car 11 includes a refractory-covered frame 12 that supports a rigid metallic framework 13 upon which the work W is stacked.

Rails 14 having their upper surfaces about flush with the floor 15 that supports the furnace serve as tracks for flanged wheels 16 on the car 11. The wheels 16 at the left end of the car as viewed in Figure I are chain-drive connected to a motor 17 that is carried on an extension 18 of the car 11 as an integral part thereof, the chain drive being indicated generally at 19. Work W to be heat treated is loaded on the car 11 exteriorly of the furnace and then is moved in from, for example, the left-hand side of the furnace as viewed in Figure I. After the heat treating is finished, the doors 7 are opened, the car 11 within the furnace is moved to the right out of the furnace and another car immediately moved into the furnace from the left to save time and loss of heat.

The car frame 12 also functions to support gas-tight seal mechanism which includes a trough 20 having a generally H-shaped form in plan as illustrated schematically in Figure V, the H-shaped trough 20 completely enclosing the car 11 on all sides and being selectively, vertically positionable by means of an elevator device hereinafter described. Depending from the horizontal furnace bottom ledges 4 are vertical sealing flanges 21 (Figure II) which as shown in Figure V have angle abutment faces 22 in juxtaposition with the doors on which faces 22 the bottom portions of the vertical seals 8 on the doors 7 bear. Depending from the refractory-covered frame 12 of the car 11 are vertical sealing flanges 23 which, as shown in Figure V, have a rectangular form in plan, the sealing flanges 21 on the furnace being stationary and the sealing flanges 23 being movable along with the car 11. The vertical sealing flanges 21 and 23 cooperate with the trough 20 in its elevated position as shown in Figure II to provide a gas-tight seal between the removable furnace bottom 10 comprising the car 11 and the furnace bottom ledges 4 when the trough 20 is filled with a suitable sealing means such as sand, water or oil 24. The openings in the side walls 3 which are closed by the doors 7 are sealed around their edges by the seals 8 on the doors which cooperate with the upper edges and side edges of the doorways and which extend down into the trough 20 as illustrated in Figure I.

Selective vertical positioning of the trough 20 is accomplished by means shown in detail in Figures III and IV, such means comprising a plurality of links 25, only one pair of which is shown in Figure III, which are pivoted on horizontally extending rods 26, carried by the car frame 12, when the links are in a first or lowered position and which are pivoted at 27 on bases or channels 28 when the links are in a second or raised position, the trough 20 being pivotally connected at 29 to the upper end of the links and the channels 28 being pivotally connected at 27 to the lower end of the links. The links 25 are shown in their lowered position in Figure III and in their raised position in Figures I and II.

Force applied to the trough 20 by any suitable means in the direction indicated by the arrow in Figure III causes the links 25 to turn clockwise about the axes of

the rods 26 until the channels 28 touch the floor 15. This is accomplished with little force. Since the channels 28 then become stationary on the floor, the links then pivot about the pivots 27 lifting the sealing means filled-trough 20 with relatively great force into cooperating relationship with the sealing flanges 21 and 23, with the lower edges of the doors 7 and with the lower portions of the vertical door seals 8 as shown in Figures I and II. As the links 25 turn clockwise about the pivots 27, the links because of their notch 30 connection with the rods 26 are permitted to move away from the rods a small distance. Such force, for example, may be applied to the trough 20 by power supplied from the hydraulic cylinders or by the motors that operate the door hoists 9. The hoists 9 include driven chains 31 which may be drivingly but detachably connected to the trough 20 through an ordinary gear reducer which may be geared down to give about a 12:1 to 24:1 mechanical advantage. With a 12:1 mechanical advantage using such an arrangement, the doors 7 would move down, for example, six feet and the trough 20 would move up six inches. Alternatively, the force might be supplied through a clutch device by the motor 17 on the car or even by hand.

After the annealing operation, the direction of the force applied to the trough 20 is reversed, the links 25 turning about pivots 27 in a counterclockwise direction as viewed in Figure III until the channels 28 are lifted clear of the floor 15 and the notches 30 in the links 25 fit snugly on the rods 26, as shown in Figure III. In such position, i.e., the lowered position, the trough 20 more or less counterbalances the channels 28 and the trough and the channels ride in neutral equilibrium on the rods 26 as the truck 11 is moved into or out of the furnace.

In summary, in operation, the furnace doors 7 are opened and the removable furnace bottom 10 comprising the car 11 is moved on rails 14 into the furnace, work W to be heat treated being loaded onto the car exteriorly of the furnace. At this time the sealing means filled-trough 20 is in lowered position and is counterbalanced by the channels 28 as illustrated in Figure III. The doors 7 are then lowered and force is applied to the trough 20 in the direction indicated by the arrow in Figure III. At first the links 25 to which the trough 20 is rockably connected turn about the axes of the rods 26. This raises the trough and lowers the channels 28 until the channels rest upon the floor 15. Then the links 25 turn about the pivots 27. This raises the trough further until lower portions of the sealing flanges 21 and 23 on the car 11 and on the furnace bottom ledge 4, respectively, the lower edges of the doors 7 and the lower portions of the vertical door seals 8 are submerged in the sealing means, such as water, oil or sand, in the trough. The trough completely encloses the car and efficiently prevents escape of gas from the furnace, the seal being not only a good one but also being one that is easily made and broken.

After the annealing cycle is completed, the doors 7 are raised and force is applied to the trough 20 in the opposite direction. This lowers the trough, breaking the gas-tight seal, and raises the channels 28 clear of the floor 15. The car 11 then is free to move on its wheels 16 along the track 14 out of the furnace.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that variations may be made therein without departing from the spirit of the invention.

I claim:

1. A furnace supported on a floor comprising, in combination, stationary walls, a removable bottom, sealing members on the stationary walls and on the removable furnace bottom, a sealing means filled-trough carried by the removable furnace bottom, and means for selectively raising and lowering the trough into and out of, respectively, cooperating relationship with the sealing members, said means for selectively raising and lowering the trough including rigid members carried by the removable furnace bottom, a plurality of links having a first and a second position, the trough being pivotally connected to the links, and a base rockably connected at pivot points on the links, the links in their first position being pivoted on the rigid members at points on the links intermediate the trough and the base and the links in their second position being pivoted not on the rigid members but at the pivot points on the base, said base being carried by the links in their first position clear of the floor and being lowered onto the floor by the links when the links are moved into their second position.

2. A furnace supported on a floor comprising, in combination, stationary walls, a removable bottom, sealing flanges depending from the stationary walls, said flanges having angle abutment faces facing the ends of the furnace, additional sealing flanges depending from the removable furnace bottom, a sealing means filled-trough carried by the removable furnace bottom, and means for selectively raising and lowering the trough into and out of, respectively, cooperating relationship with the sealing flanges, said means for selectively raising and lowering the trough including rigid members carried by the removable furnace bottom, a plurality of links having a first and a second position, the trough being pivotally connected to the links, and a base rockably connected at pivot points on the links, the links in their first position being pivoted on the rigid members at points on the links intermediate the trough and the base and the links in their second position being pivoted not on the rigid members but at the pivot points on the base, said base being carried by the links in their first position clear of the floor and being lowered onto the floor by the links when the links are moved into their second position.

3. A furnace supported on a floor comprising, in combination, stationary walls, a door on a wall, sealing means on the door to prevent escape of gas around the top and the sides of the door, a removable furnace bottom adapted to pass through the door, sealing members on the stationary walls and on the removable furnace bottom, a sealing means filled-trough carried by the removable furnace bottom, and means for selectively raising and lowering the trough into and out of, respectively, cooperating relationship with the bottom of the door and with the sealing members, said means for selectively raising and lowering the trough including rigid members carried by the removable furnace bottom, a plurality of links having a first and a second position, the trough being pivotally connected to the links, and a base rockably connected at pivot points on the links, the links in their first position being pivoted on the rigid members at points on the links intermediate the trough and the base and the links in their second position being pivoted not on the rigid members but at the pivot points on the base, said base being carried by the links in their first position clear of the floor and being lowered onto the floor by the links when the links are moved into their second position.

4. A furnace comprising, in combination, stationary walls, a door on a wall, sealing means on the door to prevent escape of gas around the top and the sides of the door, a removable furnace bottom adapted to pass through the door, sealing flanges depending from the stationary walls, said flanges having angle abutment faces facing and in juxtaposition with the door, whereby the sealing means on the door cooperates with the abutment faces when the door is closed, additional sealing flanges depending from the removable furnace bottom, a sealing means filled-trough carried by the removable furnace bottom, and means for selectively raising and lowering the trough into and out of, respectively, cooperating relationship with the bottom of the door and with the sealing flanges, said means for selectively raising and lowering the trough including rigid members carried by the removable furnace bottom, a plurality of links pivoted

on the rigid members, the trough being pivotally connected to the links at one side of the rigid members, and a base pivotally connected to the links at the other side of the rigid members.

5. A furnace supported on a floor comprising, in combination, stationary walls, a door on a wall, sealing means on the door to prevent escape of gas around the top and the sides of the door, a removable furnace bottom adapted to pass through the door, sealing flanges depending from the stationary walls, said flanges having angle abutment faces facing and in juxtaposition with the door, whereby the sealing means on the door cooperates with the abutment faces when the door is closed, additional sealing flanges depending from the removable furnace bottom, a sealing means filled-trough carried by the removable furnace bottom, and means for selectively raising and lowering the trough into and out of, respectively, cooperating relationship with the bottom of the door and with the sealing flanges, said means for selectively raising and lowering the trough including rigid members carried by the removable furnace bottom, a plurality of

links having a first and a second position, the trough being pivotally connected to the links, and a base rockably connected at pivot points on the links, the links in their first position being pivoted on the rigid members at points on the links intermediate the trough and the base and the links in their second position being pivoted not on the rigid members but at the pivot points on the base, said base being carried by the links in their first position clear of the floor and being lowered onto the floor by the links when the links are moved into their second position.

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