June 28, 1960 S. F. WILBUR 2,942,742

FURNACE CONVEYOR

Filed April 16, 1959 2 Sheets-Sheet 1

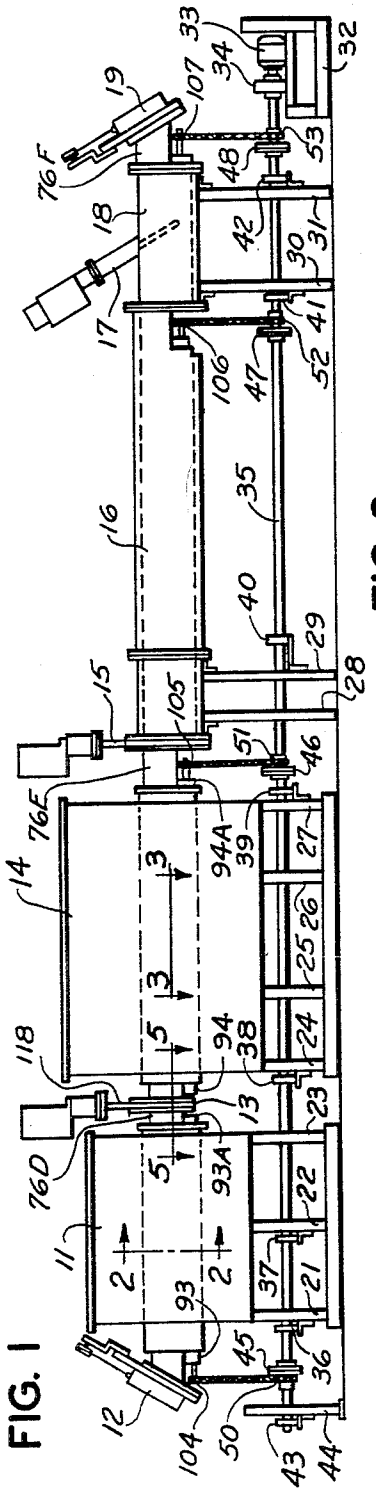


FIG. 1

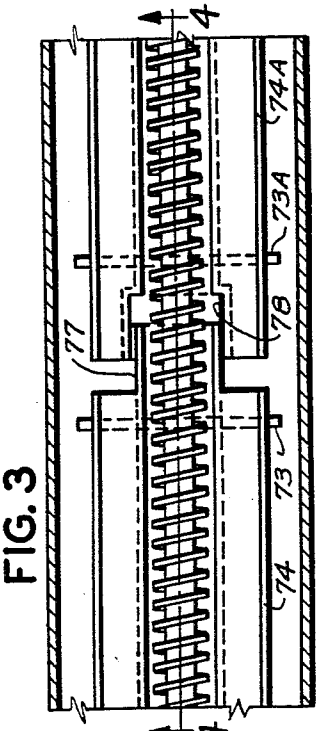


FIG. 3

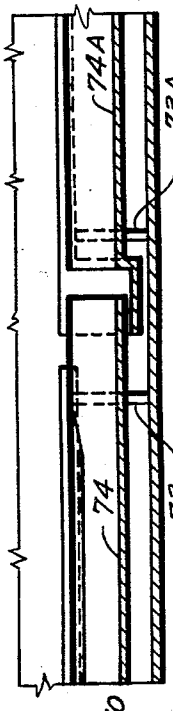


FIG. 4

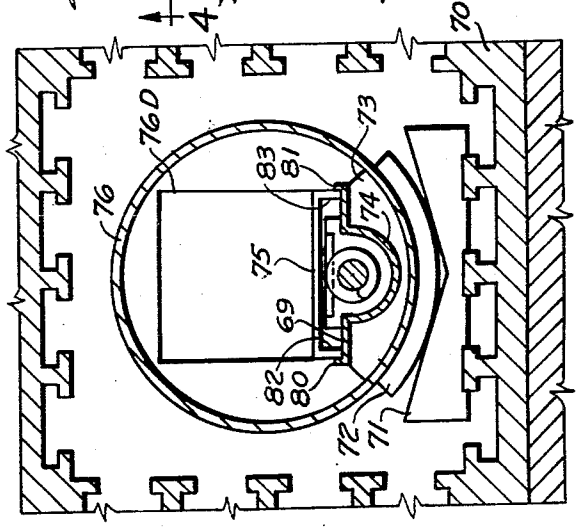


FIG. 2

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June 28, 1960 S. F. WILBUR 2,942,742

FURNACE CONVEYOR

Filed April 16, 1959 2 Sheets-Sheet 2

FIG. 5

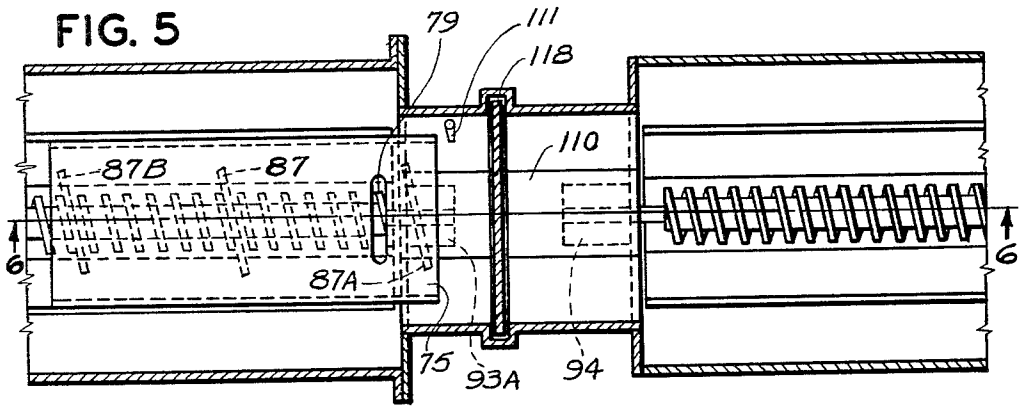


FIG. 6

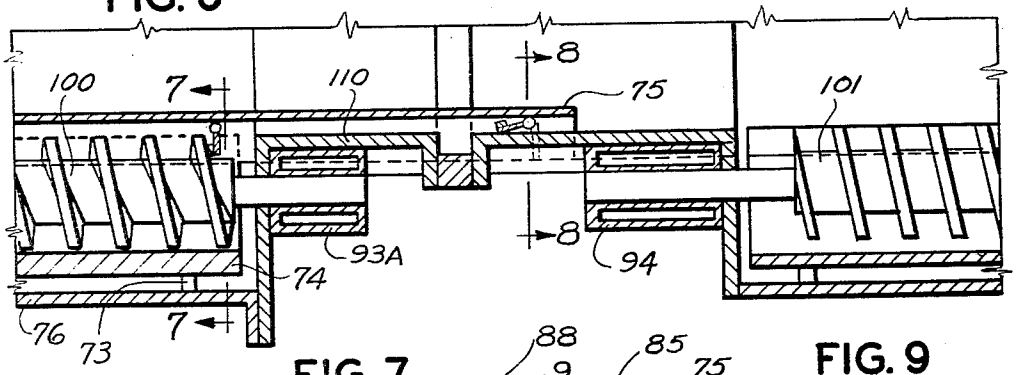


FIG. 7

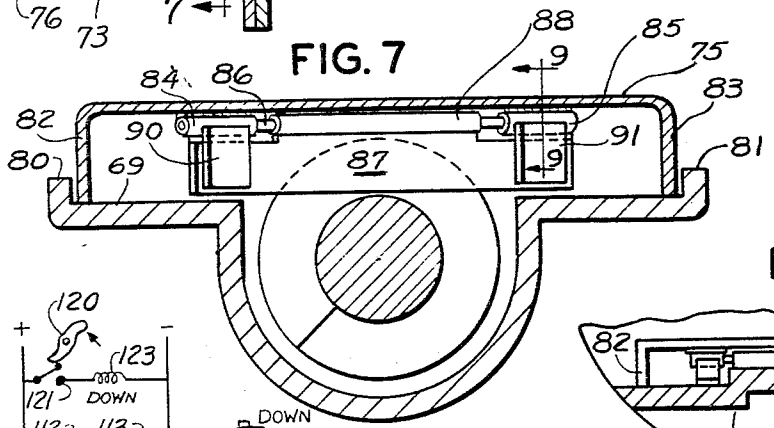


FIG. 9

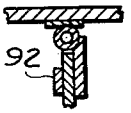


FIG. 8

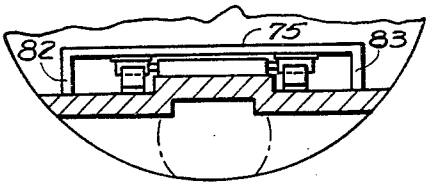
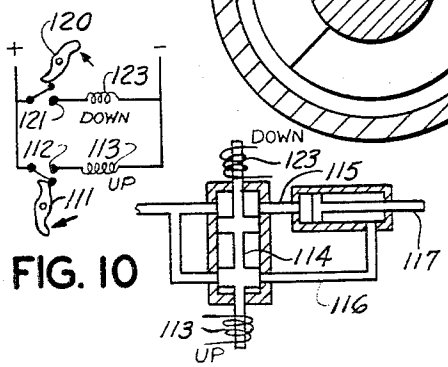


FIG. 10



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FURNACE CONVEYOR

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6 Claims. (Cl. 214—18)

This invention relates to a furnace conveyor and more particularly to a conveyor for furnaces having a plurality of chambers; each chamber being atmospherically isolated from the adjacent chamber.

An object of the present invention is to provide a conveyor for a furnace having a plurality of atmospherically isolated chambers.

Another object of the present invention is to provide an individual positive moving conveyor in each chamber of a multiple chamber furnace with means to transfer a work carrying tray over the threshold separating the chambers.

Another object of the present invention is to provide a conveyor with means for passing a tray in a continuous and uniform movement through a plurality of separate furnace chambers. The chambers forming part of an atmospherically controlled furnace of the high heat variety (100 degrees–2250 degrees Fahrenheit). The moving parts of the conveyor are always in compression and never under tension engagement with the tray.

And another object of the present invention is to provide a conveyor with means to actuate doors between separate furnace chambers and thereby maintain a high degree of purity of atmosphere in the individual chambers. Thus, minimizing atmospheric contamination of the atmosphere of one chamber with the atmosphere of an adjacent chamber.

Still another object of the present invention is to provide continuous conveyor means in a furnace having a plurality of chambers. The conveyor means providing for intermittent operation within individual chambers.

And still another object of the present invention is to provide a screw thread conveyor in conjunction with a work carrying tray in which the screw thread is under a constant uniform load as it pushes the work carrying tray through a furnace having an extremely high temperature.

And still another object of the present invention is to provide a screw thread type conveyor which moves a work tray through a furnace with means on the work tray to override the screw thread and be advanced through the furnace ahead of the screw conveyor cycle.

Other objects of the present invention will become apparent in part and be pointed out in part in the following specification and claims.

In the past conveyors of the continuous type in atmosphere controlled high heat furnaces consisted of a continuous belt. The belt subjected alternately to heat baths of 1700 degrees Fahrenheit and room temperatures stretched and contracted repeatedly, creating fatigue which shortened the life span of the belt. Frequent break downs with material isolated within the furnace was the rule. In addition the belt was always under tension as it pulled the work load through the hot furnace. This tension further decreased the life of the belt.

The present invention obviates all of the disadvantages of prior art conveyors in high heat furnaces by pushing

the work load, instead of pulling the work load, through the furnace and by isolating sections of the conveyor in the individual furnace chambers. Thus eliminating alternate heat baths and the consequent heat caused stresses.

The present conveyor has obviated shock and jerks in conveyor operation by providing a uniformly rotating screw thread. Thus obviating breakdowns occasioned by the jerking of the conveyor belt in taking up slack. The present conveyor is located in the area of lowest temperature within a heat chamber.

Similar characters of reference refer to similar parts in the following drawings, in which:

Figure 1 is a side elevational view of a multiple chamber, high heat, atmospherically controlled furnace provided with the new and improved furnace conveyor.

Figure 2 is a fragmentary transverse cross sectional view taken along line 2—2 of Figure 1.

Figure 3 is a fragmentary horizontal cross sectional view taken along line 3—3 of Figure 1 showing trough construction.

Figure 4 is a fragmentary vertical cross sectional view taken along line 4—4 of Figure 3.

Figure 5 is a fragmentary horizontal cross sectional view taken along line 5—5 of Figure 1.

Figure 6 is a fragmentary vertical cross sectional view taken along line 6—6 of Figure 5 with the tray slightly advanced across the threshold.

Figure 7 is a fragmentary cross sectional view slightly enlarged, taken along line 7—7 of Figure 6 looking in the direction of the arrows.

Figure 8 is a fragmentary sectional view taken along line 8—8 of Figure 6.

Figure 9 is a fragmentary sectional view taken along line 9—9 of Figure 7.

Figure 10 is a diagrammatic view illustrating the mechanism for opening and closing the door between chambers.

Attention is directed to Figure 1 wherein is illustrated a four chamber atmosphere controlled furnace provided with the new and improved furnace conveyor. Chamber 11 is a pre-heat chamber having doors 12 and 13 which atmospherically seal pre-heat chamber 11.

Chamber 14 is a high heat chamber having doors 13 and 15 which atmospherically isolate high heat chamber 14. Chamber 16 is a cooling chamber having doors 15 and 17 which atmospherically isolate cooling chamber 16. Chamber 18 is a discharge chamber having doors 17 and 19 which atmospherically isolate discharge chamber 18.

Chamber 11 is supported upon legs 21, 22 and 23. Chamber 14 is supported upon legs 24, 25, 26 and 27. Legs 28, 29, 30 and 31 support chambers 16 and 18. A motor mount 32 is provided to support an electric motor 33 and a gear reduction unit 34. A shaft 35 operatively connected to motor 33 through gear reduction unit 34 is rotatively supported in bearings housed in brackets 36, 37, 38, 39, 40, 41, 42 secured to legs 21, 22, 24, 27, 29, 30 and 31 respectively. A bearing bracket 43 secured to a stanchion 44 functions as an outboard mounting for shaft 35. Magnetic clutches 45, 46, 47 and 48 having sprocket wheels 50, 51, 52 and 53 respectively, forming part of the idling sections of said magnetic clutches, are secured to shaft 35.

Hearth plate supports 71 of refractory material are placed in spaced relation within the walls 70 of chamber 11. Hearth plate refractory bricks 72 are laid upon the hearth plate supports 71. A muffle 76 in the form of a hollow circular pipe is supported upon bricks 72. The construction of chamber 14 is identical to that for chamber 11. A muffle section 76D square in cross section connects chamber 11 with chamber 14. Chambers 16 and 18 are equivalent in construction to muffle sec-

tion 76D. That is square in cross section. Muffle section 76E connects the muffle in chamber 14 to chamber 16. Muffle section 76F forms part of chamber 18.

A plurality of saddles 73 of cast alloy are secured to muffle 76 in spaced relation. A trough comprising a multiple number of sections 74, 74A in spaced relation which ride in muffle 76 and upon saddles 73. One end of trough section 74 is provided with a tongue 77. The other end of a trough section 74A is provided with a groove 78 to create a tongue and groove heat expansion joint. The outside edges 80, 81 of the trough sections 74, 74A are turned up ninety degrees to provide a track 69. The center of a trough section is formed into a semicircular housing. There is an identical arrangement of trough sections in each one of the chambers 11, 14, 16 and 18.

A tray 75 (see Figures 5 and 7) is provided with ninety degree turned down opposite sides 82, 83 which ride upon the tracks 69 and guided in the track by edges 80, 81. Tray 75 is provided with two bearings 84, 85. A shaft 86 is rotatively mounted in bearings 84, 85. A flipper 87 is provided with a bearing 88 which is rotatively mounted upon shaft 86. Two stops 90, 91 secured to bearings 84, 85 respectively, limit the forward pivotal movement of flipper 87. A series of weights 92 are fixed to flipper 87 to cause it to tend to hang vertically. Tray 75 is provided with a plurality of flippers 87 illustrated as three in number in Figure 5. Tray 75 is provided with a slot 79 for purposes which will presently appear.

Opposite ends of hollow circular pipe muffle 76 are provided with water cooled pillow block bearings 93, 93A. Individual screws 100 are located in the semicircular housings of troughs 74, 74A, and are rotatively mounted in pillow block bearings 93, 93A. Similarly, screw 101 is mounted in pillow blocks 94, 94A. There are similar individual screws in chambers 16 and 18.

The ends of the shafts of screws 100, 101 etc., are provided with sprockets 104, 105, 106, 107 respectively, and are aligned with sprockets 50, 51, 52, 53, respectively. Sprocket chains connect the respective pair of sprockets to each other.

Each square section of muffle 76D, 76E, etc., is provided with a platform or threshold 110 (see Figure 6), which is in a horizontal plane with the top edge of screw 100, for purposes which will presently appear.

In square sections 76D, 76E and 76F and in chamber 18, a dog similar to dog 111 is pivotally mounted to be actuated by tray 75. Dog 111 operatively controls a momentary contact switch 112 which energizes a solenoid valve 113 causing an air valve piston 114 to move upwardly and thereby block conduit 115 and open conduit 116. Piston 117 is thereby caused to shift and open door 118 for example. Dog 120 is actuated by the upward movement of door 118. Actuation of dog 120 closes momentary contact switch 121, thereby energizing solenoid valve 123 and causing air valve piston 114 to move downward, thereby blocking conduit 116 and opening conduit 115 to shift piston 117 and close door 118. In a like manner doors 15, 17 and 19 are actuated.

An electrical control panel is provided which controls the glow bars (not shown) in the pre-heat chamber 11 and high heat chamber 14. The control panel also controls magnetic clutches 45, 46, 47, 48 and electric motor 33. The control panel also controls the electric circuit which opens entering door 12. The glow bars and electrical control panel are not shown because they are incidental to the present invention and well known in the art.

In operation entering door 12 is opened. A tray 75 carrying a work load is pushed through the door opening until a flipper 87 falls between the convolutions of screw 100. Door 12 is closed. Motor 33 is energized to rotate shaft 35. Magnetic clutch 45 is energized to rotate the section of screw 100 located within pre-heat chamber 11. By energizing and de-energizing magnetic clutch 45, screw 100 is caused to rotate or not rotate through sprockets 50, 104 and their chain drive connection, so that the work load on tray 75 will remain in pre-heat chamber 11 for a period of time under control of the electrical control panel.

After the pre-determined pre-heat period has expired, magnetic clutch 45 will be energized and thereby rotate screw 100 which will push tray 75 carrying a work load through pre-heat chamber 11. The convolutions of screw 100 pushing tray 75 through flipper 87 are under compression and are located in the bottom of chamber 11. Continued movement of tray 75 through chamber 11 will cause the edge of tray 75 to rotate dog 111 and thereby close momentary contact switch 112 which energizes solenoid valve 113 to shift air valve piston 114 and thereby open door 118 to allow tray 75 to pass across threshold 110 between pre-heat chamber 11 and high heat chamber 14 and enter chamber 14 to engage flipper 87 with the convolutions of screw 101 in chamber 14.

As tray 75 approaches threshold 110 it leaves the guidance provided by edges 80, 81 of trough 74. The sides of square muffle 76D provide the guidance across the threshold 110 that edges 80, 81 of track 69 provided through chamber 11. In addition threshold 110 (see Figures 5 and 6) as a raised portion causes the first of the plurality of flippers 87 to swing or pivot rearwardly and thereby disengage the convolutions of screw 100. The distance from the forward flipper 87A to the rearmost flipper 87B must be greater than the length of threshold 110 so that the forward flipper 87A engages the convolutions of screw 101 in chamber 14 before the flipper 87B is disengaged from the convolutions of screw 100 in chamber 11. It will be observed that as the forward flipper 87A on tray 75 pivots out of contact with the convolutions of screw 100 the other of the plurality of flippers 87, 87B still engaging screw 100 and will continue to push tray 75 across threshold 110 until flipper 87A engages screw 101 in chamber 14. Screw 101 then takes over to continue to push tray 75 through chamber 14. In like manner tray 75 passes through the remaining chambers.

If for any reason it is necessary or desirable to withdraw the tray 75 from the chambers, all that is necessary is to open the doors, reach into the chambers with a hooked withdrawing rod, engage slot 79 with the hook and pull the tray toward the normal exit chamber. Flippers 87, 87A and 87B will bounce across the top of the convolutions of the several screws and across the thresholds.

Screws 100, 101 etc. may be fabricated completely from refractory material. Prior art conveyors were unable to be completely fabricated from this high heat resistant material.

Having shown and described a preferred embodiment of the present invention, by way of example, it should be realized that structural changes could be made and other examples given without departing from either the spirit or scope of this invention.

What I claim is:

1. A furnace conveyor for use in a chamber having a muffle, consisting of a trough having a horizontal platform constituting a track, with opposite parallel edges of said platform bent vertically to form guiding edges for said track, the center of said platform formed into a circular housing, a screw thread rotatively mounted on opposite ends in said muffle and located in said circular housing with the top edge of said screw extending vertically above the horizontal plane of said horizontal platform, a tray formed with opposite vertical parallel edges which slide on said track and lie between the guiding edges of said track, a flipper pivotally mounted to said tray, a stop fixed to said tray to limit the pivotal move-

ment of said flipper in one direction, said flipper engaging said screw to push said flipper against said stop to move said tray along the track on said trough.

2. A furnace conveyor for use in an atmosphere controlled furnace having a plurality of chambers, a separate conveyor in each chamber, a tray for holding the work, a plurality of pivotal means on said tray adapted to engage said conveyors for moving said tray through said chambers, movable closure means for separating said chambers one from the other, mechanism for moving said movable closure means to open position and means adjacent said doors and engaged by said tray for actuating said mechanism to allow said tray to pass from one chamber to the next adjacent chamber.

3. A conveyor for use in an atmosphere controlled furnace comprising a plurality of chambers, a door between adjacent chambers to isolate one chamber from the next adjacent chamber, a plurality of screws, one for each chamber, means to rotate each screw independent of the screw in the adjacent chamber, a track fixed in each chamber, a tray, pivotal means on said tray to engage the screw in each chamber to slide said tray along said track, said last named pivotal means disengaging the screw in one chamber and engaging the screw in the adjacent chamber to slide said tray from the track in one chamber to the track in the adjacent chamber and means operable in timed relation of the sliding of the tray through a chamber to open and close the door between adjacent chambers to allow said tray to pass from one chamber to the adjacent chamber.

4. A conveyor for use in an atmosphere controlled furnace comprising a multiple number of separate chambers, a multiple number of separate hollow circular muffles, one fixed in each of said separate chambers, a multiple number of hollow square muffles, one for each side of each chamber, each hollow square muffle fixed to the end of a hollow circular muffle with the hollow square muffle between adjacent chambers uniting said adjacent chambers to form a continuous hollow path through the multiple number of hollow square and circular muffles, a multiple number of doors slidably mounted, one in each hollow square muffle, a plurality of screws, one for each separate chamber, means to rotatively mount each screw in each chamber independently of the screw in the adjacent chamber, a track in each hollow circular muffle, said square muffles being of a width to form a continuation of the track in the adjacent muffle, a tray, two flippers mounted to each tray to pivot through an arc of approximately ninety degrees, said flippers engaging the screw to push said tray along the track, the hollow square muffles having means to disengage said flippers from the screw, and said two flippers spaced from each other a distance greater than the width separating one screw from the next adjacent screw so that one flipper is always in engagement with one screw to push said tray along the continuous track.

5. A conveyor for use in an atmosphere controlled furnace comprising a plurality of chambers, a threshold between adjacent chambers, a door slidably mounted in each threshold, a trough fixed in each chamber, a plurality of screws, rotatively mounted, one in each trough, means to rotate said screws, a track on each trough in horizontal alignment with the threshold of the adjacent chamber, a tray having two or more screw engaging means spaced a distance greater than the width of the threshold slidingly mounted on said track, said threshold disengaging said screw engaging means to permit said screw engaging means to pass over said threshold to engage the screw in the next trough, and means operable by said tray to open and close said doors in timed relation of the tray sliding along said track and across the thresholds.

6. A furnace conveyor for use in an atmosphere controlled furnace comprising a plurality of chambers, a plurality of muffles, one for each chamber, a plurality of muffle sections, each muffle section square in cross section and provided with a raised threshold, each muffle section connected on opposite ends to the muffle ends of muffles in adjacent chambers, a plurality of doors one for each muffle section, each door slidingly mounted in a muffle section, mechanism for moving each door to open and closed position, a plurality of troughs one for each muffle, each trough having track means and provided with a centrally located circular housing and mounted for heat expansion and contraction in a muffle, each track means and each threshold lying in a horizontal plane, a plurality of individual screws, one for each muffle and rotatively mounted in each muffle and located in the circular housing of the trough in each muffle, a tray slidingly guided in said track means in said troughs and by the side walls of said muffle sections provided with a plurality of pivotal means for engagement with said screws, said screws pushing said pivotal means and thereby said tray along said track means and across said thresholds, said pivotal means being spaced apart a distance greater than the width of said thresholds, a drive shaft provided with a plurality of magnetic clutches, one for each screw, and drive means connecting said magnetic clutches to each of said screws whereby rotation of said drive shaft selectively rotates said screws through said magnetic clutches and means actuated by said tray to actuate said mechanism for moving said doors from closed to open position and back to closed position.

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