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DOOR CONSTRUCTION

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Fig. 1

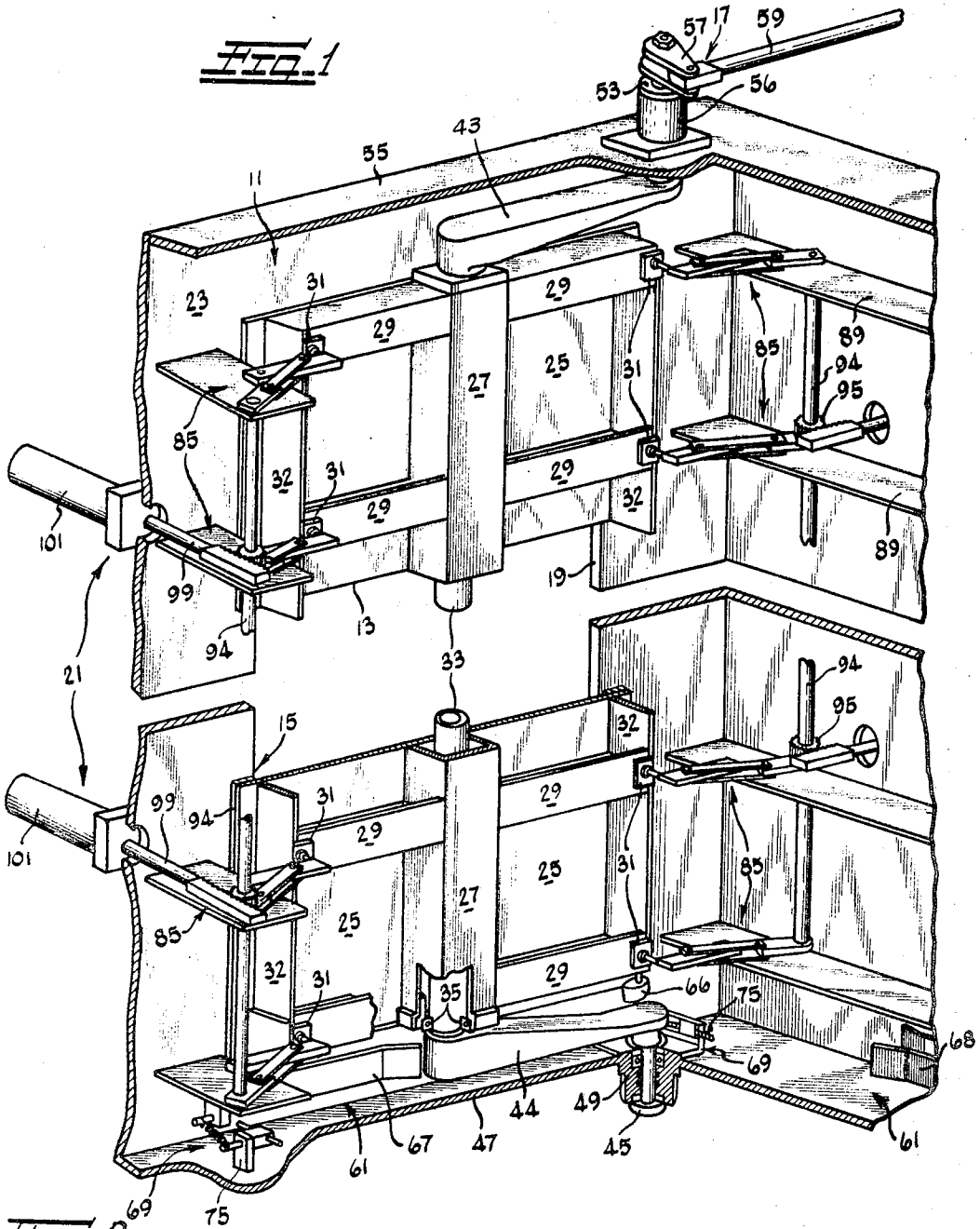

Fig. 2

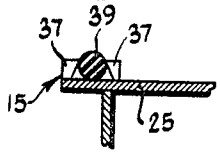

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Fig. 5

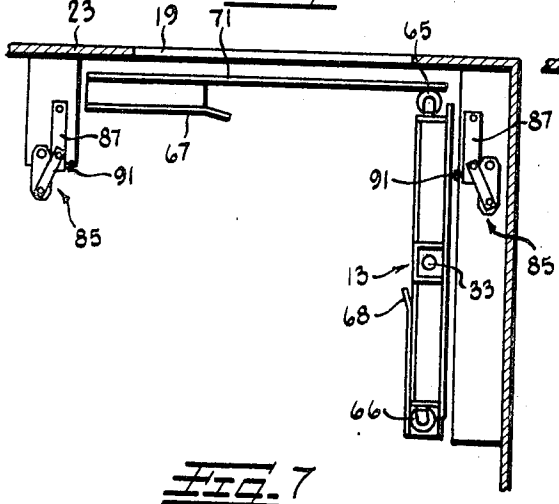


Fig. 6

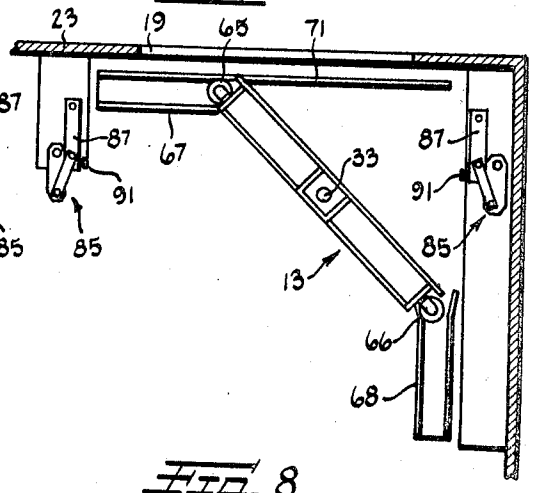


Fig. 7

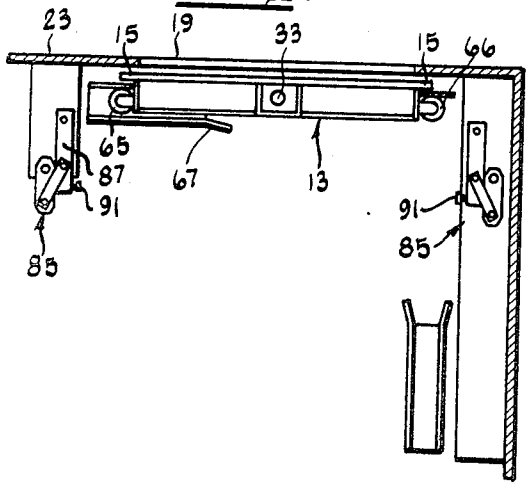
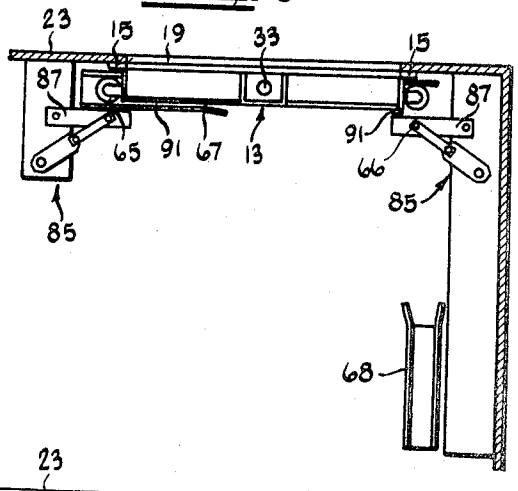


Fig. 8



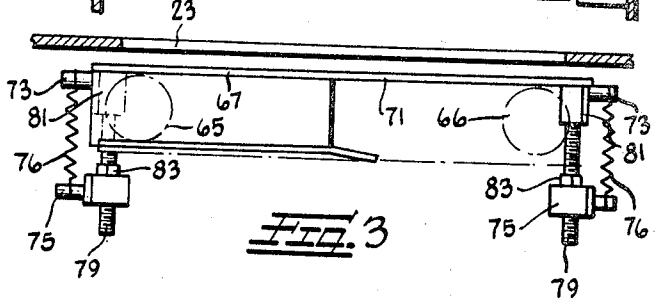


Fig. 3

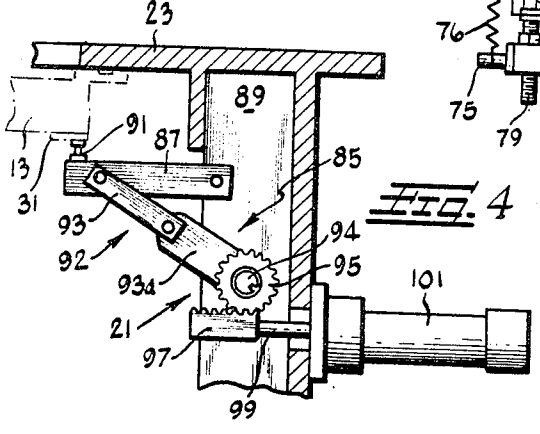


Fig. 4

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3,436,861

DOOR CONSTRUCTION

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U.S. Cl. 49—246 2 Claims

ABSTRACT OF THE DISCLOSURE

A door construction is described for closing and sealing a port through which objects are delivered along a fixed path that is generally perpendicular to the plane of a portion of a wall defining the port. Drive means move a gate from an open position with the gate generally parallel to the fixed path, to a position in which the gate is parallel with the wall. Clamping means move the gate, when in the latter attitude, into sealing engagement with the wall to obstruct the port.

This invention relates generally to a door construction, and relates more particularly to an improved door construction which is adapted for sealing a port in a furnace.

Various types of door constructions are known for providing access to a furnace or other enclosure. A principal problem encountered in door constructions is the amount of space required in order to open the door to its fullest extent. In many instances this space is desirably kept at a minimum.

It is particularly desirable to keep the space required to open and close the door at a minimum in a vacuum furnace where the door is housed within a vacuum lock. Further, the volume of the vacuum lock is desirably kept as small as possible in order to reduce the size of the vacuum pumps necessary to pump down the lock before the door to the furnace is opened.

In many instances, such as in a vacuum furnace for heat treating or coating sheet glass, it is desirable to provide a suitable conveyor system within the vacuum lock for delivering the sheets of glass into the furnace. In a furnace of this type the glass sheets are introduced into the furnace through the vacuum lock intermittently and the furnace door must be opened and closed as each sheet is passed through the port into the furnace.

The conveyor within the vacuum lock is desirably positioned as close to the wall of the furnace as possible in order that the sheets of glass may be readily transferred from the conveyor in the vacuum lock to a conveyor or other support structure within the furnace. Accordingly, the door construction desirably operates in a manner so that the area directly in front of the furnace port is not obstructed and may be occupied by a suitable conveyor.

To facilitate the maintenance of a high rate of production and to minimize the time to which the interior of the vacuum furnace is exposed to the vacuum lock, the door should be capable of closing rapidly and have a low inertia. Further the construction should be such as to facilitate maintenance of support and sealing structures. The door construction should also be capable of providing a good vacuum seal which may be broken and resealed often without destruction or deterioration of the sealing means.

Accordingly, it is a main object of the present invention to provide a structurally sturdy improved door construction. A more particular object is to provide an improved door construction for sealing in a vacuum furnace port. A further object is to provide a fast-acting door construction having low inertia, and a still further object is to provide an improved door construction requiring a

relatively small operating space and which does not obstruct the area directly in front of the door during opening and closing of the door. Still a further object is to provide a sealable door construction wherein the sealing means is protected from adverse environmental conditions and is operated so as to minimize abrasion of the sealing means. A still additional object is to provide a door construction which facilitates the maintenance of the supporting and sealing components thereof.

Other objects and advantages of the present invention will become apparent through reference to the following description and accompanying drawings, which show an illustrative embodiment of this invention, wherein:

FIGURE 1 is a perspective view of a specific embodiment of a door construction including certain features of the present invention;

FIGURE 2 is an enlarged plan view of a portion of the door illustrated in FIGURE 1;

FIGURE 3 is a plan view of a portion of the door construction illustrated in FIGURE 1 with a portion of the door shown in phantom for clarity of illustration;

FIGURE 4 is an enlarged plan view of still another portion of the door construction illustrated in FIGURE 1;

FIGURE 5 is a reduced sectional view of the door of FIGURE 1 in an open position;

FIGURE 6 is a reduced sectional view of the door of FIGURE 1 in a partially closed position;

FIGURE 7 is a reduced sectional view of the door of FIGURE 1 in a closed but unsealed position; and,

FIGURE 8 is a reduced sectional view of the door of FIGURE 1 in a closed and sealed position.

Briefly, the door construction illustrated includes a gate **13** having a sealing means **15** upon one surface thereof. The apparatus further includes a drive means **17** for moving the gate into position to obstruct a port **19**. To actuate the sealing means **15** and also to maintain the gate securely in position, a clamping means **21** is provided.

More particularly, the door construction is adapted for obstructing an elongated port of approximately forty square feet in area. For purposes of illustration, the apparatus is displayed in co-operation with a wall **23** of the type which may be used for enclosing a glass furnace. The gate **13** is designed to have a shape similar to that of the port **19** but with a slightly greater area so that the entire port **19** will be obstructed. While the gate **13** of the illustrated embodiment obstructs the entire port **19**, an alternate embodiment of this invention may, however, be designed for obstructing only a portion thereof.

The gate **13** includes a rectangular plate **25** preferably constructed from aluminum plate or other suitable light weight sheet material and further includes a centrally disposed, longitudinally oriented, hollow conduit **27** which is secured to the plate **25** by welding or other means. To improve the rigidity of the plate **25**, transversely oriented ribs **29** are positioned upon opposite sides of the conduit **27** and are secured to the plate **25** along the back side thereof as clearly illustrated in FIGURE 1. A seating area for the clamping means **21**, comprising a flat member **31**, is secured upon the rearwardly facing surface of the ribs **29** as shown in FIGURE 1. Further, structural support is provided by the longitudinally oriented plates **32** which are secured to the ends of the ribs **29** and the longitudinal edges of the plate **25**. To provide coupling to the drive means **17**, a rotatably mounted rod **33** is provided which is journaled through the conduit **27** and supported therein by bearings **35**.

The sealing means **15** previously mentioned is secured to the periphery of the plate **25** to provide a tight seal between the gate **13** and the wall **23**. The sealing means is secured to the port side of the plate **25** so that when the gate is opened the sealing means will be protected

from the heat given off from the glass passing into the furnace. The sealing means illustrated in FIGURE 2 includes a pair of beveled strips 37 tack-welded about the periphery of the plate and defining an area larger but similarly shaped as the port 19. The beveled portion of the strips 37 are fitted about an O-ring sealing member 39 constructed of resilient material which is secured to the plate 25 by the dovetail construction of the strips 37. The member 39 is constructed of a material having thermal resistivity sufficient to withstand the heat of the furnace. An alternate embodiment may have the sealing member and strips secured to the periphery of the port.

The means 17 for moving the gate 13 through its various conditions includes a pair of support arms 43 and 44 which are rotatably secured to the ends of the rod 33. The remaining end of the lower support arm 44 is secured to a rod 45, which is journaled through the floor 47 of the enclosure and maintained therein by suitable bearing means 49. The remaining end of the upper support arm 43 is secured to a rod 53 which is journaled through the roof 55 of the enclosure by suitable bearing means 56. To actuate the rod 53 a pair of parallel links 57 are secured to the uppermost end of the rod as illustrated in FIGURE 1. The ends of the links 57 are secured to a drive shaft 59 which is reciprocally actuated by suitable means (not shown).

Guide means 61 are provided for guiding the gate 13 as it traverses through its various positions. The guide means comprises two downwardly depending wheel bearings 65 and 66 which are secured to the ends of the lowermost rib 29, as illustrated in FIGURE 1 and shown in phantom in FIGURE 3. To receive the wheel bearing 65 an upwardly facing guide channel 67 is provided which is positioned adjacent the wall 23 below the port 19. To receive the wheel bearing 66 when the gate 13 is in its open position a second guide channel 68 is secured adjacent the wall 23.

To prevent scuffing of the sealing means 15 and facilitate movement of the gate 13, the channel 67 is provided with a biasing means 69 for biasing it away from the surface of the wall 23 during movement of the gate 13. Referring to FIGURE 3, channel 67 is upwardly positioned to receive the wheel bearings 65 and is of a length slightly longer than one-half of the gate 13. The forward wall 71 of the channel 67 extends approximately the entire length of the gate 13. The biasing means 69 includes two longitudinally projecting members 73, which extend outwardly from the ends of the channel and two upright standards 75, which are secured to the floor 47, and positioned adjacent the ends of the channel 67. Coil springs 76 are secured to the standards 75, and the member 73 urging the channel 67 away from the wall 23. To facilitate adjustment of the distance which the channel 67 will move under the influence of the springs 76, an adjusting screw 79 is threaded through the standard 75 for engagement with a stop member 81, provided upon the channel 67. To lock the setting of the adjusting screw 79 a lock nut 83 is threaded upon the adjusting screw 79 for mating engagement with the surface of the standard 75.

The clamping means 21 comprises a plurality of clamp assemblies 85, arranged about the longitudinal sides of the gate 13. Since the clamp assemblies 85 are of similar construction, one assembly will be described for purposes of illustration. The assembly 85 illustrated in FIGURE 4 includes a clamp arm 87, journaled for rotation adjacent one end through a support member 89 of the wall 23. The free end of the arm 87 is provided with a stop 91 for surface engagement with the seating area 31 of the rib 29 as previously described. To rotate the arm 87 a linkage 92 is provided which includes two straight members 93 and 93*a* rotatably secured together. One end of the member 93 is journaled through the free end of the clamp arm 87, and one end of 93*a* is keyed to a drive shaft 94 for rotation therewith. To rotatably actuate the drive shaft 94 a pinion gear 95 is keyed to the drive shaft 94, so that as the gear 95 is rotated in a clockwise direction, as viewed in FIGURE 4, the stop upon the end of the clamp arm 87 will move toward the gate 13. To rotate the gear 95, a rack 97 is provided which meshes with the gear 95. The rack 97 is secured to a drive shaft 99 for reciprocal movement by drive means 101.

FIGURES 5 through 8, inclusive, illustrate various positions which the gate 13 may maintain during operation. FIGURE 5 illustrates the gate in its open condition. It should be noted that in this position or portion of the gate 13 obstructs the port 19. The wheel bearing 66 is maintained within the guide channel 68 and the bearing 65 depends freely. Further, in this position, the clamp assemblies 85 are in their retracted positions, and the spring biased guide channel 67 is held away from the wall 23 by the coil springs 76.

To close the gate, the drive means 17 is energized forcing the drive shaft 59 to reciprocate. The reciprocatory movement of the drive shaft 59 is translated through the links 57 to the rod 53, causing the rod 53 and the support arm 43 to rotate. Since the arm 43 is rotatably secured to the rod 33, and the rod 33 is rotatably secured to the support arm 44 which in turn is journaled in the floor of the enclosure, the rotation of the links 57 cause the door to swing from the position of FIGURE 5 to the position of FIGURE 6. In the position of FIGURE 6 the wheel bearings 65 engage the guide channels 67. As the support arms 43 and 44 move the rod 33 further, the gate 13 is guided by the channel 67, with the wheel bearing 66 being freed from the guide channel 68. The continued rotation of the support arms 43 and 44 causes the gate 13 to be moved to a position adjacent to and parallel with the wall 23. In this position, the gate 13 is held slightly away from the wall by the outwardly biased guide channel 67 as illustrated in FIGURE 7. To securely maintain the gate 13 against the wall 23, and to actuate the sealing means 15, the clamping means 21 are actuated causing the drive means 101 to eject the drive shaft 99 rotating the pinion gear 95 thereby forcing the stops 91 provided upon the ends of the clamp arms 87 against the gate 13. In this manner, the gate 13 is biased against the wall 23 defining the port 19 and the sealing means 15 are actuated thereby providing a tight seal between the wall 23 and the gate 13 about the port 19 facilitating the maintenance of a vacuum within the furnace. The movement of the gate 13 under the influence of the clamp arms 87 tends to increase the tension of the coil springs 76.

To open the gate, the clamp assemblies 85 are released by retracting the rack 97 thereby withdrawing the clamp arms 87. As the arms 87 are withdrawn, the gate 13 is urged away from the wall 23 by the spring biased channel 67 thereby releasing the sealing means 15. The gate 13 may then be moved to its open position by causing the support arms to move counterclockwise as viewed in FIGURE 8. The biasing of the channel 67 permits the gate 13 to be moved without scuffing or otherwise damaging the sealing means 15. Further, if a pressure reversal should arise between the interior and exterior of the furnace forcing the door outward, the door will be self releasing thus preventing possible furnace damage. It should be noted that the gate 13 is moved generally along the wall rather than rotated outwardly. Thus, a minimum of operational area is required to operate the valve thereby permitting the location of conveyors and other associated equipment in proximity with the port 19.

I claim:

1. A door construction for closing and sealing a port through which objects are delivered along a fixed path that is generally perpendicular to the plane of a portion of a wall defining said port, said door construction comprising a gate, drive means including pivotal support means for moving said gate from an open position in which said gate lies in a plane generally parallel to said fixed path to a closed position in which said gate lies in

a path generally parallel to the plane of the portion of the wall defining said port, said gate being pivotally mounted on said support journaled on an axis displaced from the axis upon which said support means are journaled, at least one roller secured to said gate, a channel member disposed transversely of said fixed path and adapted to receive said roller for guiding said gate such that said gate pivots in the opposite direction from said support means into a position transverse to said fixed path, said channel member being movable in a direction generally parallel with said fixed path, biasing means for urging said channel member away from said wall defining said port, and clamping means for moving said gate, when the plane thereof is generally parallel to the plane of the portion of the wall defining said port, into sealing engagement with the wall defining said port.

2. A door construction in accordance with claim 1 wherein said clamping means comprises a plurality of clamps secured to said wall about the periphery of said

port, each of said clamps comprising a hinged linkage one end of which is journaled upon a clamp arm one end of which is rotatably supported, a gear secured to the remaining end of said linkage, and means for rotating said gears so as to position the remaining end of said clamp arm against the surface of said gate so as to move said gate into engagement with said wall.

References Cited

UNITED STATES PATENTS

3,145,021 8/1964 Anderson ..... 49—395 XR

FOREIGN PATENTS

678,982 9/1952 Great Britain.

KENNETH DOWNEY, *Primary Examiner.*

U.S. Cl. X.R.

49—395