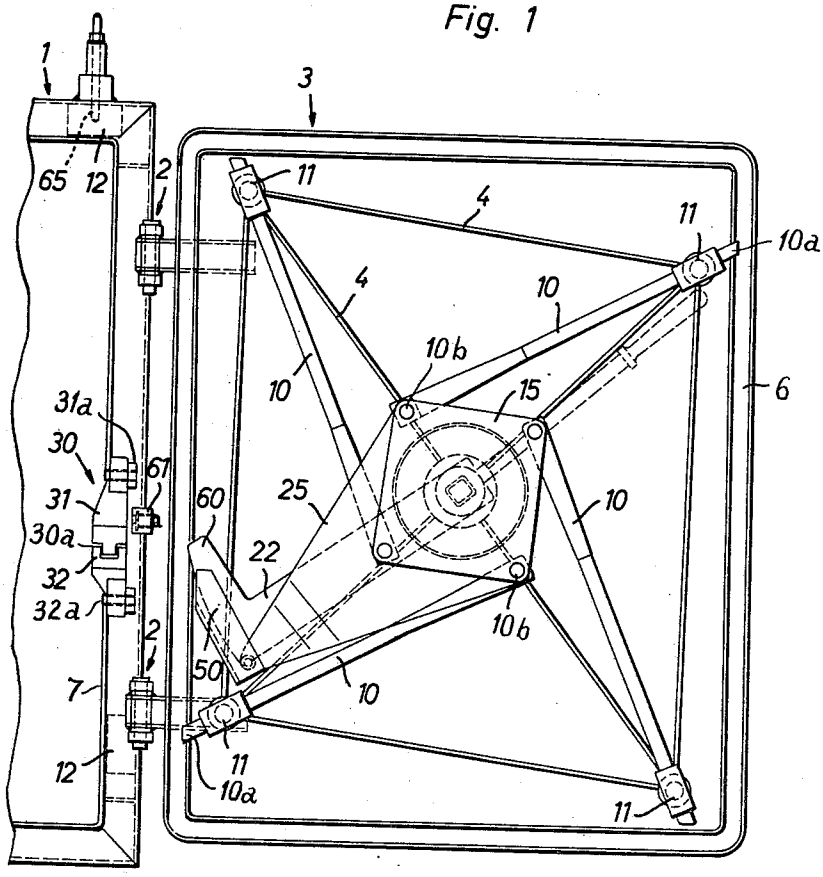
May 7, 1963 A. BEHRENS ETAL 3,088,548

HERMETICALLY SEALED HOIST-SHAFT DOOR

Filed Sept. 19, 1961 4 Sheets-Sheet 1

Fig. 1



May 7, 1963 A. BEHRENS ETAL 3,088,548

HERMETICALLY SEALED HOIST-SHAFT DOOR

Filed Sept. 19, 1961

4 Sheets-Sheet 2

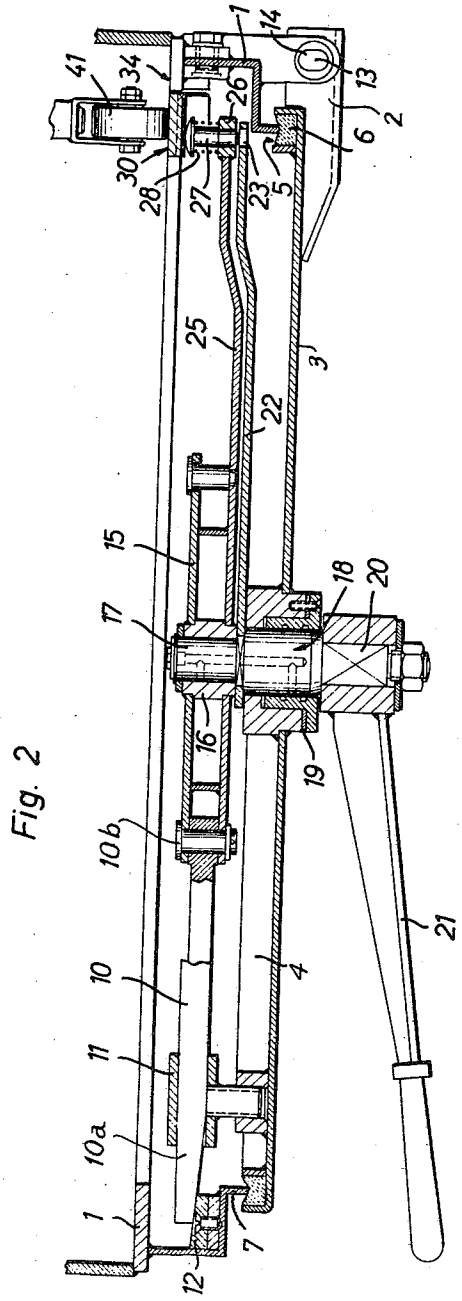


Fig. 2

May 7, 1963 A. BEHRENS ETAL 3,088,548

HERMETICALLY SEALED HOIST-SHAFT DOOR

Filed Sept. 19, 1961 4 Sheets-Sheet 3

Fig. 3

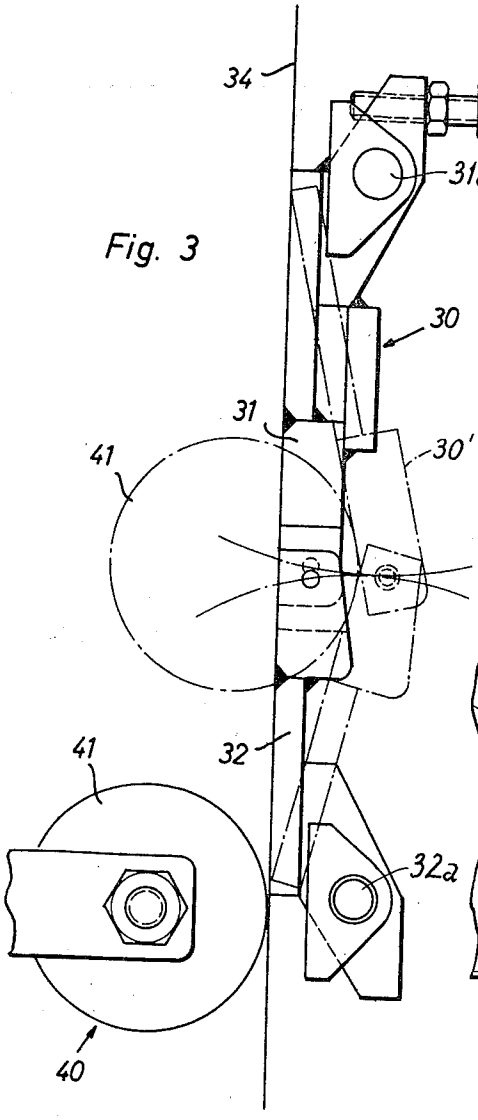
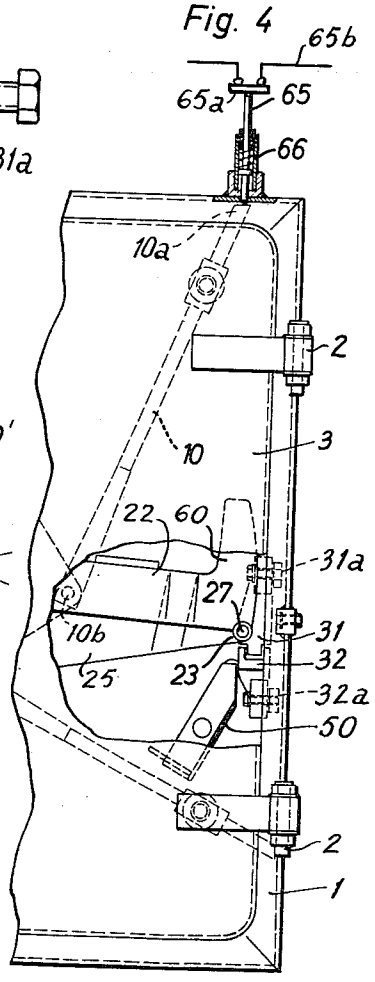


Fig. 4

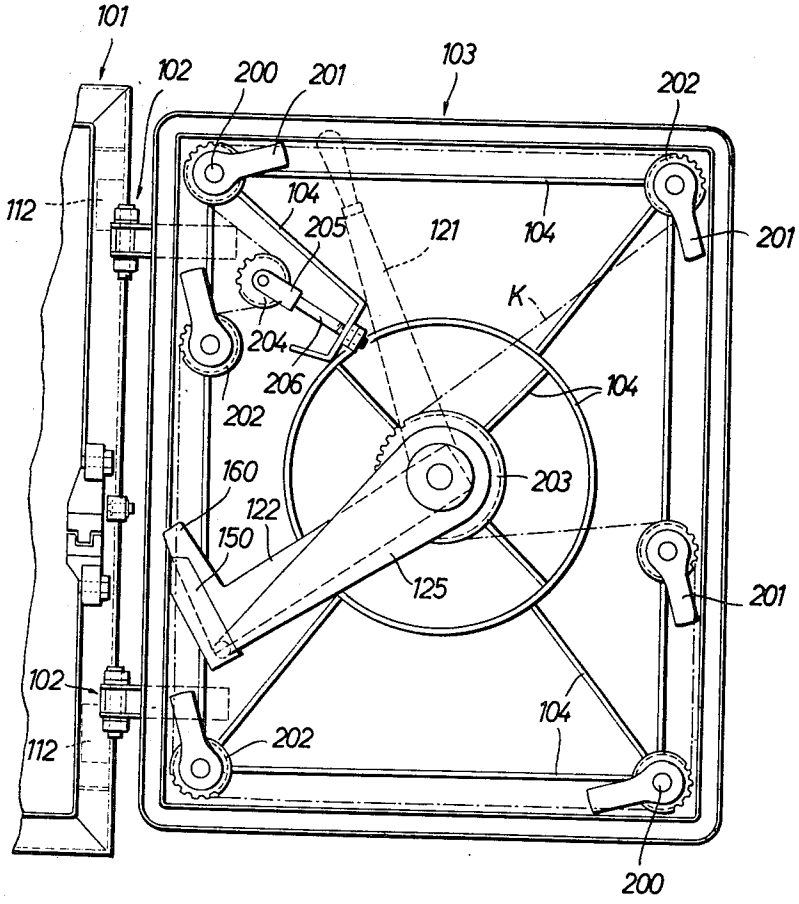


May 7, 1963 A. BEHRENS ETAL 3,088,548

HERMETICALLY SEALED HOIST-SHAFT DOOR

Filed Sept. 19, 1961 4 Sheets-Sheet 4

Fig. 5



United States Patent Office

3,088,548

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HERMETICALLY SEALED HOIST-SHAFT DOOR

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Claims priority, application Germany Sept. 21, 1960
11 Claims. (Cl. 187—61)

Our invention relates to a hoist-shaft door which, when closed, is gas-tightly sealed in its frame. Such doors are used particularly for ammunition hoists where it is often necessary to normally keep the hoist shaft closed hermetically.

It is an object of the invention, therefore, to provide a door which, when shut, forms a reliable gas-tight seal with its door frame in the hoist shaft wall, and also to reliably prevent accidental opening of the door in a simple manner as long as the hoist cage has not come to a stop in front of the door, as is generally necessary in hoists.

According to our invention, we provide one of the two door parts which are to be sealed relatively to each other with a packing around the door opening, and equip the door with a plurality of locking elements which are arranged on its inner side and the ends of which can be brought simultaneously into and out of engagement with wedging tracks arranged in the door frame, such engagement being controlled by an operating lever arranged on the outside of the door; and we interpose between the operating lever and the locking elements a coupling mechanism normally biased to disengaged position and automatically set to active coupling position by a control element provided on the hoist cage, as soon as the latter has reached the door.

According to more specific features of the invention, we mount in the door a pivot shaft or pin which passes through the door in a gas-tight manner and to whose outer end a manual operating lever is fixed, whereas the inner end carries a freely rotatable control member for displacing the locking elements. Also seated upon the inner end of the pivot pin but not rotatable relative thereto is a coupling arm which can be coupled to the control element of the locking elements and forms part of the aforesaid coupling mechanism. By turning the operating lever about its pivot axis, the locking mechanism can be operated from the outside in a simple manner, provided the normally inactive coupling mechanism is activated by the arrival or presence of the hoist cage. The locking elements, whose ends cooperate with wedging tracks in the door frame, secure a hermetic seal by firmly pressing the frame and the door edge against each other when the door is closed. To make certain that the door opening is reliably sealed on all sides, it is preferable to provide at least four locking elemnts which can engage behind the wedging tracks of the frame in the region of the four respective corners of the door. This requires providing sufficient clearance at the door hinges to permit a movement of the door as a whole perpendicularly to the plane of the door.

The above-mentioned coupling mechanism is preferably spring-loaded in the direction towards its uncoupling position. Thus, when the door is closed and the hoist cage has not reached the level of the door, opening of the door is impossible. Although the operating lever on the outside of the door can be moved, since the coupling element is disengaged, such movement has no effect on the locking elements.

In order to enable the manual operating lever to be coupled with the locking elements when the hoist cage

is level with the door and the door is to be opened, a control member, preferably a roller, is mounted on the hoist cage so as to travel together with the cage and, by abutting against the coupling mechanism, move that mechanism to the coupling position to then permit opening of the door.

Mounted in the door frame is an operating pin for an electric safety switch whose contacts are connected in the control circuit of the hoist motor. The switch pin is so arranged in the region of one of the wedging tracks that the arssociated locking element engages and actuates the switch pin shortly before the locking element reaches its end position on the wedging track. As a result, the hoist motor can start only when the door is closed and sealed.

The invention will be explained in more detail hereinafter with reference to two embodiments illustrated by way of example on the accompanying drawings, in which:

FIG. 1 shows part of a frame with a door hinged thereto, the door being in open position,

FIG. 2 is a cross section through the frame part and the door, the door being in closed position.

FIG. 3 is a side elevation, showing an operating device for the coupling member, and

FIG. 4 is a fragmentary view as seen from the outside, showing the parts in the locked position.

FIG. 5 is a view similar to FIG. 1 illustrating another embodiment.

In FIGS. 1 to 4 of the drawings, **1** designates a door frame which can be mounted in an air-tight manner in the hoist-shaft wall and advantageously consists of a welded steel section structure. The door **3** is hinged to one side of the frame by means of hinges **2**. As shown particularly in FIG. 2, the door **3** preferably consists of a steel plate with reinforcing ribs **4** welded thereto. In order to reinforce door **3**, reinforcing ribs **4** are disposed on the inner side of the door, which ribs may be welded to the door-panel. The reinforcing ribs **4** preferably extend between the bearings **11** for the locking levers **10** as well as between these bearings and the middle of the door in which the control means is situated. The ribs are welded to the stationary bearing portion for the control shaft **18**. Provided along the door edge, on the inner side thereof, is a groove **5** in which a continuous packing or gasket strip **6** is embedded. The frame **1** comprises an outwardly projecting flange **7** which extends around the door opening and is so arranged that, when the door is closed, its outer edge penetrates into the groove **5** and thus into the packing **6**.

The door is provided with locking bars **10** which serve to force the door **3** against the frame **1** to provide an air-tight seal. In the example illustrated there are four such locking bars **10** which extend diagonally outward approximately from the middle of the door. In the corner regions of the door, the locking bars are slidably mounted in respective rotatable guides **11**. The active ends **10***a* of the locking bars are preferably bevelled in wedge-shaped manner and engageable with respective wedging tracks **12** in the door frame. The wedging tracks **12** are also inclined, so that when the locking bars engage with the tracks, the door is drawn inward toward the frame, and the flange **7** is pressed into the packing **6**. For also securing an air-tight seal at the hinge side of the door, the hinge pins **13** of hinges **2** are guided in slots **14** which permit limited displacement of the door perpendicularly to its own plane.

The inward ends of the locking bars **10**, situated in the middle region of the door, are pivotably connected at **10***b* to a control plate **15**. The plate **15** and the locking bars **10** thus form together a toggle or knee-action mechanism which causes locking or unlocking motion of the bars by rotation of the plate. The plate **15** prefer-

ably consists of a stiffened welded structure and is rigidly fastened to a hub **16** freely rotatable on the inner end **17** of a pivot pin **18** revolvably mounted in the middle of the door. The mounting of the shaft **18** in the door is made air-tight by appropriate packings **19**. The pivot pin protrudes through the door to the outside and carries at its outer end **20** an operating lever **21** with a handle by means of which the pivot pin **18** can be rotated.

Also seated on the pivot pin **18** at the inner side of the door is a connecting arm **22** which is fixed for rotation together with the pin, for example by means of a square seating portion of the pin. The connecting arm **22** extends between the door **3** and the plate **15** in the direction toward the hinged side of the frame **1**. At the outer end of the connecting arm **22**, there is provided a coupling eye **23**.

Another connecting arm **25** is rigidly fastened to the plate **15** and likewise extends from plate **15** in the direction toward the hinged side of the door frame. The end of arm **25** has a guide eye **26** in which a coupling pin **27** is mounted for axial displacement. A spring **28** holds the coupling pin in a position in which one end of the said pin is substantially flush with the front surface of the guide eye **26**. The arm **25** of plate **15** and the connecting arm **22** can be brought into a position relatively to one another in which the bore of the guide eye **26** is in line with the coupling eye **23**, so that in this position the pin **27** can be pushed into the coupling eye **23** against the action of the spring **28**. When this happens, the two arms **22** and **25** are coupled together, and hence the operating lever **21** is coupled with the crank plate **15** and the locking bars **10** so that the locking mechanism can be operated by manipulating the lever **21**.

As mentioned, the spring **28** normally holds the coupling pin **27** out of the coupling eye **23**. In order to engage the pin, there is provided an operating device, generally designated by **30**, which comprises a two-part hinged member whose two parts **31** and **32** are hingedly connected to one another at **30***a* (FIG. 1) and whose other ends are hinged to the frame by pivots **31***a*, **32***a*. The hinged member is so arranged on the frame that its two parts can be selectively brought into an aligned position shown in full lines in FIG. 3, in which the parts **31**, **32** are in line with one another and form a surface flush with the rear wall **34** of the hoist shaft, or into a deflected position in which the two hinged parts are positioned as shown at **30'** in dot-and-dash lines in FIG. 3.

As shown in FIG. 4, the locking mechanism, when the door is closed, is in a position in which the head of the coupling pin **27** assumes a position substantially in the central region of the hinged member **30**, so that the head of pin **27** is pressed resiliently against the hinged member by the spring **28**. Connected to the hoist cage is an operating element indicated generally by the reference **40** which element comprises a roller **41** pressed resiliently against the inner wall **34** of the shaft. This roller is so arranged that, as the hoist cage moves, it can roll onto the hinged member and press it inward to the position **30'** due to the spring-loading of the roller. Thus the coupling pin **27** is also depressed into its coupling position against the action of spring **28**. Hence, the locking mechanism can now be disengaged by turning the handle lever **21**, and the door can be opened.

Since, when the crank plate **15** is rotated to disengage the locking bars **10** from the wedging tracks **12** of the frame, the coupling pin **27** is moved out of contact with the hinged element **31**, a fixed guide **50** (FIGS. 1, 4) is provided on the door which, when the door is closed, as shown in FIG. 4, is located immediately adjacent the hinged element **31** in a position such that the head of the locking pin **27** slides onto it after leaving the hinged element. This guide **50** holds the pin **27** in the coupling position during the further pivoting movement of the arms **22** and **25**, until the pin again slides onto the hinged element when the door is being reclosed.

Since, in the uncoupled state, the operating lever **21** and the connecting arm **22** are freely rotatable relative to each other, means must be provided for preventing displacement of the coupling pin **27** until the pin is in line with the coupling eye **23** of the connecting arm **22**. For this purpose, the connecting arm **22** has an extension tongue **60** which in every position except the coupling position retains the pin **27** until it can engage in the coupling eye **23**.

For maintenance purposes or in other urgent cases, the door may have to be opened even if the hoist cage is not opposite the door. For this purpose the door frame is provided with a closable access opening **61** (FIG. 1) which, when opened, permits access to the hinged member **30**. A tool can then be pushed through the opening against the hinged member to move it to the deflected position **30'** (FIG. 3) so that the door can then be opened by turning the operating lever **21**.

To prevent the hoist cage from being moved as long as the door is not hermetically closed, the frame **1** is provided with an operating pin **65** (FIG. 4) for a safety switch **65***a* which, in known manner, is connected in the control circuit **65***b* of the hoist motor. The pin **65** is biased by a spring **66** to a position in which the safety switch **65***a* is open. When the door is open, the lower end of the pin **65** projects, as shown in FIG. 1, into the region of a wedging track **12** in the door frame **1**. As the door is being closed, the latch end of one of the locking bars **10** runs onto the track **12** and thus presses the door in an air-tight manner against the frame. Shortly before reaching its end position, the extremity of the locking bar **12** presses against the switch pin **65** and pushes it into the raised position in which it closes the safety switch. Only then can the hoist winch be operated. As soon as the door is opened, the locking bar **10** releases the pin **65** so that the latter is returned by spring **66** to the lowered position. The safety switch also comes into action if the operating device **30** for the coupling pin **27** is operated from the access aperture **61**, without the hoist cage being in position in front of the door.

FIG. 5 is a view corresponding to FIG. 1 of a door according to a further embodiment of the invention. In FIG. 5, those parts which correspond to like parts in FIG. 1 are indicated by the same reference numerals increased by 100.

A door frame **101** shown partly broken away, is provided with hinges **102** and with wedging tracks **112** for the locking elements. Instead of locking bars, the door **103** according to this embodiment has latch members **201** rotatably mounted on respective pivot pins **200**. The latches **201** can be turned from the position shown in FIG. 5 into engagement with the wedging tracks **112** when the door is closed. Each latch **201** is coaxially and rigidly joined with a sprocket **202** to rotate together therewith.

A sprocket wheel **203** is freely rotatable on the pivot pin of the operating lever **121**. As in the embodiment according to FIGS. 1 to 5, the driving connection between the operating lever **121** and the sprocket wheel **203** is obtained by intermediate members **122** and **125**. Since the operation of the coupling comprising these intermediate members is the same as in the embodiment already described, this part of the device need not be further explained.

An endless driving chain passes about the sprockets **202** and the sprocket wheel **203**, so that the rotation of the sprocket wheel **203** results in simultaneous rotation of all sprockets **202** and latches **201**. Advantageously, the chain also passes about a tensioning wheel **204** which is journalled in a fork **205** and is adjustable by means of a screw-threaded spindle for tensioning the chain. The spindle is in threaded engagement with a bore in a reinforcing rib **104** of the door. The number of latch members is of no particular importance. It is advantageous, however, to provide at least four such members. In the case of doors of larger size than that according to this embodiment, ad-

ditional latch members may be provided near the side edges of the door.

It will be obvious to those skilled in the art, upon studying this disclosure, that our invention permits of various modifications with respect to design details and hence can be given embodiments other than particularly illustrated and described herein, without departing from the essential features of our invention and within the scope of the claims annexed hereto.

We claim:

1. A hermetically sealable hoist-shaft door, comprising a frame structure, a door structure hinged to said frame structure, one of said structures having a packing extending around said door structure and sealingly engageable by the other structure when the door is tightly closed, a plurality of locking elements mounted on said door structure on the inner side thereof and having each a latch end, wedging tracks mounted on said frame structure, said latch ends being simultaneously engageable with and disengageable from said respective wedging tracks, a pivot pin revolvably mounted in said door structure in gas-tightly sealed relation thereto and having respective ends inside and outside said door structure, an operating lever rigidly mounted on the outer end of said pivot pin, a control member rotatably seated on the inner end of said pivot pin and connected with said locking elements for simultaneously moving said latch ends by rotation of said control member, a coupling mechanism having an arm fixed on the inner end of said pivot pin for rotation together therewith, said coupling mechanism having coupling means movable between inactive and active positions respectively and engaging said arm for entrainment of said control member only when in said active positions, spring means biasing said coupling means to said inactive position, and control means actuable under control by the hoist cage and engageable with said coupling means for moving it to said coupling position when the hoist cage is at the level of the door.

2. In a hoist-shaft door according to claim 1, said control means comprising a hinged member pivotally mounted on said frame structure and in engagement with said coupling means, said hinged member having a normal position in which said coupling means is in uncoupled position and a surface of said hinged member is substantially flush with the hoist-shaft wall, spring means biasing said hinged member to said normal position, said hinged member being adapted to be engageable at said surface by a part on the hoist cage so as to be deflected away from said normal position when said cage is in front of the door, whereby said coupling means is moved to said coupling position.

3. In a door according to claim 2, said hinged member comprising two parts individually hinged to said frame structure and having their respective free ends hingedly engaging each other with clearance, said two parts being aligned with each other when said hinged member is in said normal position and being angularly positioned relative to each other when said hinged member is deflected from said normal position.

4. A hermetically sealable hoist-shaft door, comprising a frame structure, a door structure hinged to said frame structure, one of said structures having a packing extending around said door structure and sealingly engageable by the other structure when the door is tightly closed, a plurality of locking bars having respective latch ends and being mounted on said door structure on the inner side thereof in pivotal and slidable relation thereto, wedging tracks mounted on said frame structure, said latch ends being simultaneously engageable with and disengageable from said respective wedging tracks, a pivot pin revolvably mounted in said door structure in gas-tightly sealed relation thereto and having respective ends inside and outside said door structure, an operating lever rigidly mounted on the outer end of said pivot pin, a control member rotatably seated on the inner end of said pivot pin linked to said locking bars so as to form a toggle lever mechanism for simultaneously moving said latch ends by rotation of said control member, a coupling mechanism having an arm fixed on the inner end of said pivot end for rotation together therewith, said coupling mechanism having coupling means movable between inactive and active positions respectively and engaging said arm for entrainment of said control member only when in said active positions, spring means biasing said coupling means to said inactive position, and control means actuable under control by the hoist-cage travel and engageable with said coupling means for moving it to coupling position when the cage reaches the door.

5. A hermetically sealable door, comprising a frame structure having hinges on one side thereof, a door structure pivotally joined with said frame structure by said hinges, one of said structures having a packing extending around said door structure and sealingly engageable by the other structure when the door is tightly closed, four locking bars mounted on said door structure on the inner side thereof and having each a latch end, and extending from the center region of the door substantially diagonally outward, wedging tracks mounted on said frame structure, said latch ends being simultaneously engageable with and disengageable from said respective wedging tracks, a pivot pin revolvably mounted in said door structure in gas-tightly sealed relation thereto and having respective ends inside and outside said door structure, an operating lever rigidly mounted on the outer end of said pivot pin, a control member rotatably seated on the inner end of said pivot pin linked to said four locking bars for simultaneously moving said latch ends by rotation of said control member into and out of engagement with said wedging tracks, said door structure having at said hinges a sufficient clearance for limited motion perpendicular to the plane of said frame structure to permit sealing at the hinge side of said frame structure, and normally inactive coupling means controllable by arrival of a hoist cage to couple said control member with said pivot pin.

6. A hermetically sealable hoist-shaft door, comprising a frame structure, a door structure hinged to said frame structure, one of said structures having a packing extending around the door opening and sealingly engageable by the other structure when the door is tightly closed, a plurality of locking elements mounted on said door structure on the inner side thereof and having each a latch end, wedging tracks mounted on said frame structure, said latch ends being simultaneously engageable with and disengageable from said respective wedging tracks, an operating member rotatably mounted on said door structure and operable from the outside thereof, a coupling mechanism interposed between said operating member and said locking elements and having coupling means movable between uncoupling and coupling positions respectively and normally biased to uncoupling position, said operating member being operatively connected with said locking elements by said mechanism when said coupling means is in said coupling position only, and control means actuable under control by the hoist cage and engageable with said coupling means for moving it to said coupling position when the hoist cage is at the level of the door, said locking elements being constituted by latch members rotatably mounted on said door structure, a sprocket coaxially joined with each of said latch members, a sprocket wheel rotatably mounted on said door structure, an endless driving chain extending about said sprockets and about said wheel for driving said sprockets and latch members when said sprocket wheel is being rotated, said operating member being drivingly connected with said sprocket wheel by said coupling mechanism when said coupling means is in said coupling position.

7. A hoist-shaft door according to claim 6, comprising a tensioning wheel engaging said chain and adjustably mounted on the inner side of said door structure.

8. A hermetically sealable hoist-shaft door, comprising a frame structure, a door structure hinged to said frame structure, one of said structures having a packing extending around said door structure and sealingly engageable by the other structure when the door is tightly closed, a plurality of locking elements mounted on said door structure on the inner side thereof and having each a latch end, wedging tracks mounted on said frame structure, said latch ends being simultaneously engageable with and disengageable from said respective wedging tracks, a pivot pin revolvably mounted in said door structure in gas-tightly sealed relation thereto and having respective ends inside and outside said door structure, an operating lever rigidly mounted on the outer end of said pivot pin, a control member rotatably seated on the inner end of said pivot pin and connected with said locking elements for simultaneously moving said latch ends by rotation of said control member, a first arm fixed on the inner end of said pivot pin for rotation together therewith, said first arm extending substantially radially away from said pivot pin and having a coupling eye at its outer end, a second arm fixed to said control member and extending radially away therefrom, a coupling pin axially displaceable in the outer end of said second arm for coupling engagement with said eye when registering therewith, spring means engaging said coupling pin and biasing it away from said eye, and control means controllable by the hoist cage and engageable with said coupling pin to move it into said eye for coupling said operating member to said locking elements when the cage is at the level of the door.

9. A hermetically sealable hoist-shaft door, comprising a frame structure, a door structure hinged to said frame structure, one of said structures having a packing extending around said door structure and sealingly engageable by the other structure when the door is tightly closed, a plurality of locking elements mounted on said door structure on the inner side thereof and having each a latch end, wedging tracks mounted on said frame structure, said latch ends being simultaneously engageable with and disengageable from said respective wedging tracks, a pivot pin revolvably mounted in said door structure in sealed reation thereto and having respective ends inside and outside said door structure, an operating lever rigidly mounted on the outer end of said pivot pin, a control member rotatably seated on the inner end of said pivot pin and connected with said locking elements for simultaneously moving said latch ends by rotation of said control member, a first arm fixed on the inner end of said pivot pin for rotation together therewith, said first arm extending substantially radially away from said pivot pin and having a coupling eye at its outer end, a second arm fixed to said control member and extending radially away therefrom, a coupling pin axially displaceable in the outer end of said second arm for coupling engagement with said eye when registering therewith, spring means engaging said coupling pin and biasing it away from said eye, a control device having two parts individually hinged to said frame structure and having their respective free ends hingedly engaging each other with clearance to permit said parts a relative motion from stretched position to angular position of said device, said device being in engagement with said coupling pin to be normally biased by said spring means to said stretched position and having a surface which is flush with the hoist-shaft wall when in said stretched position and is adapted to be engaged by a control part on the hoist cage whereby said device is deflected to said angular position and moves said coupling pin into said eye to permit opening of the door by actuation of said operating member.

10. A door according to claim 9, comprising a fixed guide mounted in the path of movement of said coupling pin and extending to the region where said coupling pin leaves said control device when said locking elements are opened, whereby said guide holds said coupling pin in engagement with said coupling eye in opposition to the force of said spring means.

11. In a door according to claim 9, said first arm having at its outer end a tongue portion extending along the path of movement of said coupling pin and being engageable with said coupling pin for preventing axial pin displacement until the coupling pin and the coupling eye are in alignment with each other.

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