May 8, 1962 R. P. SAAR ET AL 3,032,835

DOOR STRUCTURE FOR PERSONNEL AND MATERIAL LOCKS

Filed Oct. 19, 1956 3 Sheets-Sheet 1

FIG. 2

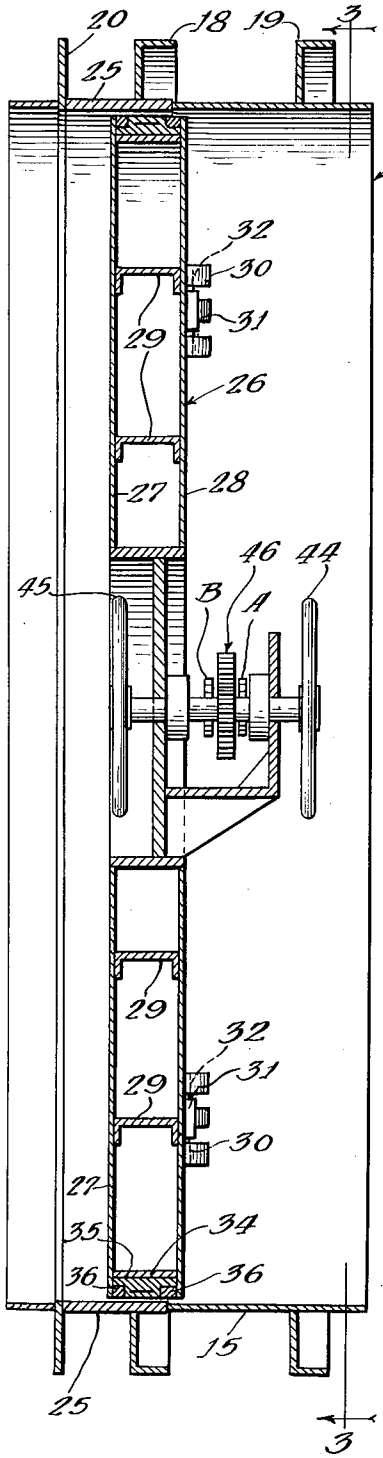


FIG. 1

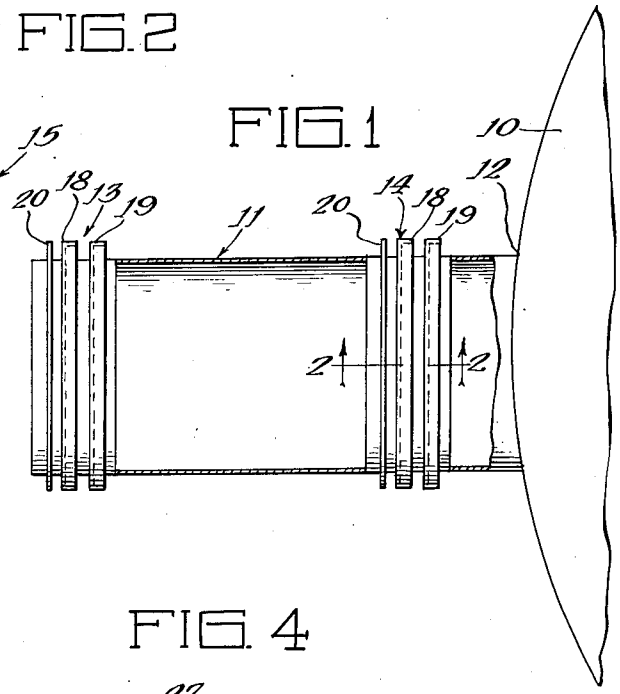
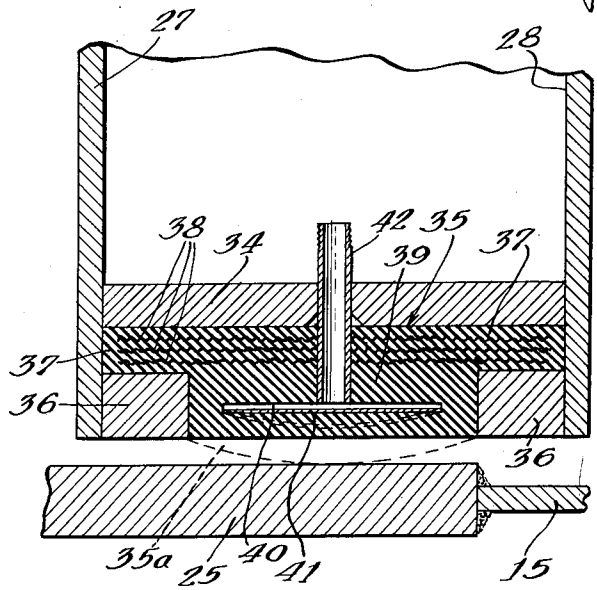


FIG. 4



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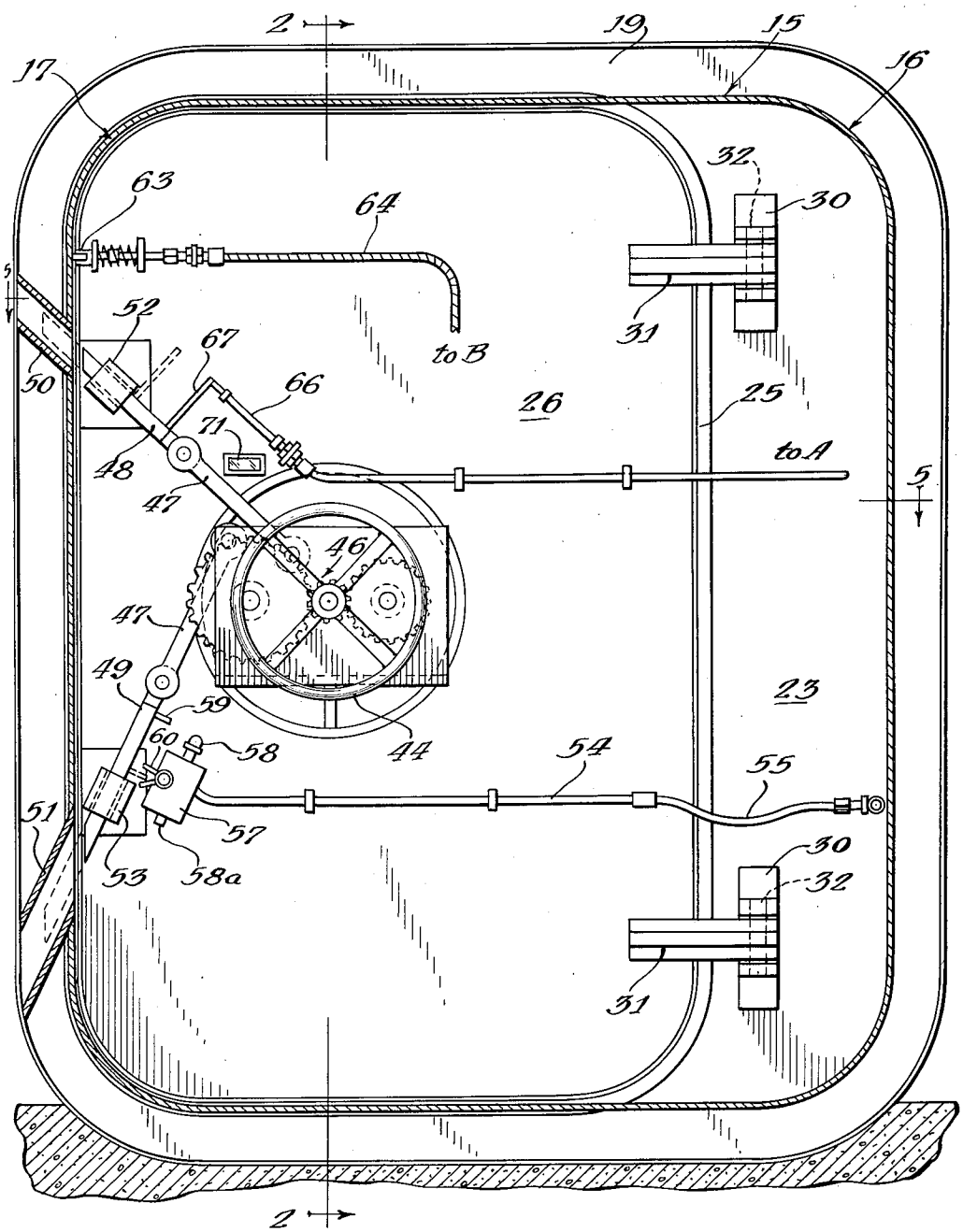


FIG 3

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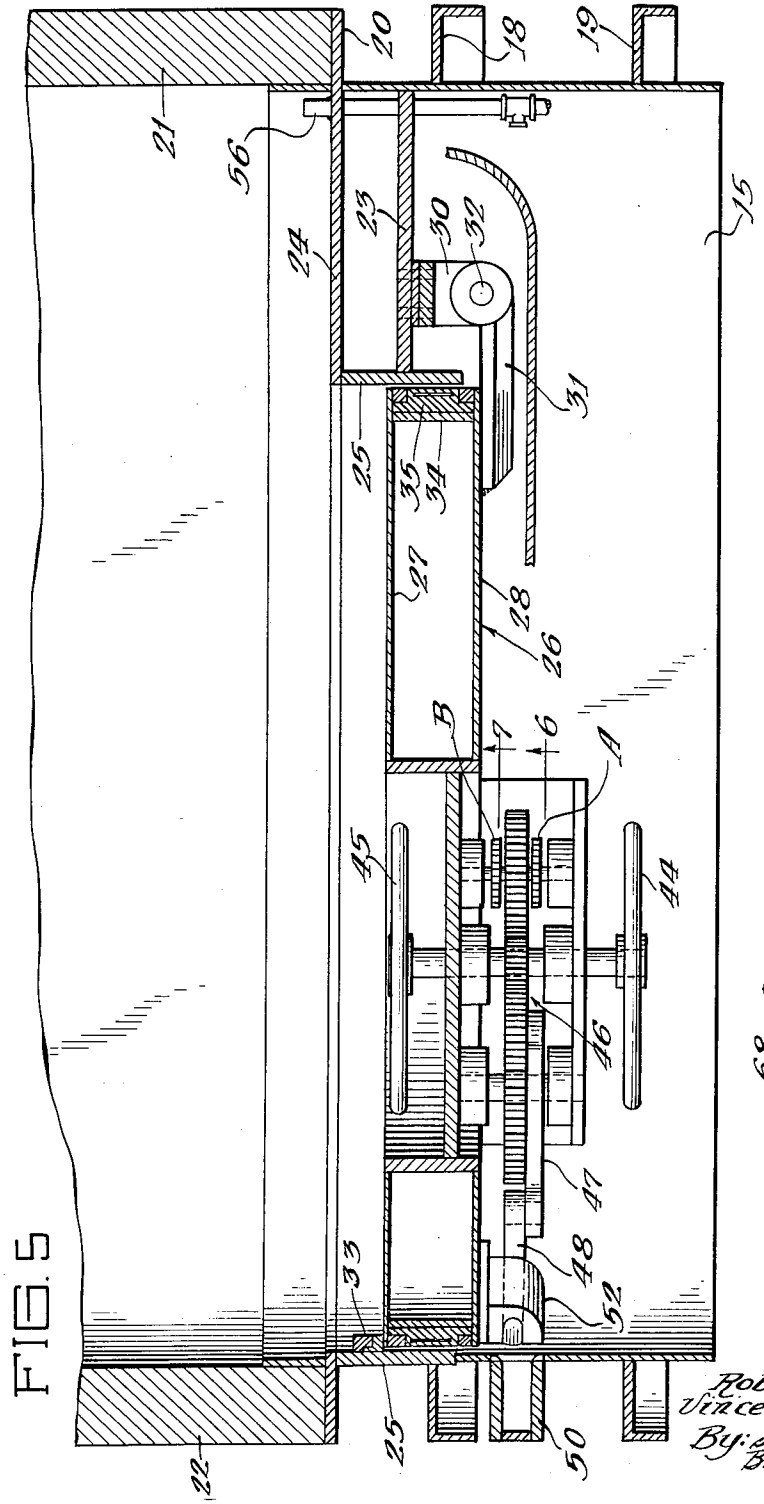


FIG. 5

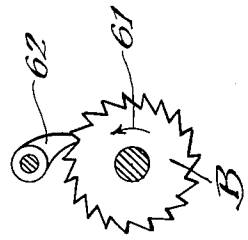


FIG. 7

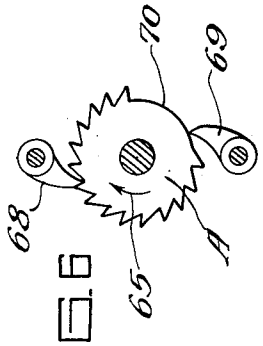


FIG. 6

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DOOR STRUCTURE FOR PERSONNEL AND MATERIAL LOCKS

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9 Claims. (Cl. 20—16)

This invention relates to personnel and material locks and more particularly to a door construction for such locks which may be securely sealed against fluid leakage when closed and locked.

There has been a problem of providing a fairly large doorway of sufficient size to pass persons and material handling vehicles and yet having the ability to be locked in closed position and thoroughly sealed. The present door construction solves this problem. The immediate use of the door construction of this application is in locks used in passages leading into a large containment vessel housing experimental nuclear reactors.

The principal object of this invention is to provide a new and improved door construction for personnel and material locks.

Another object is to provide a door section complete with frame and housing so that it may be incorporated directly as a unit into a tunnel lock construction.

Another object is to provide a door construction of the character described wherein the door is quite freely movable into and out of its opening and yet may be completely sealed into the frame about its entire periphery.

Another object is to provide a door for locks which will seal itself into its opening automatically upon locking of the door in closed position.

Other objects, features and advantages of the present invention will be apparent from the following description of a preferred embodiment illustrated in the accompanying drawing, in which—

FIGURE 1 is a fragmentary top plan view of a material and personnel lock leading into a nuclear reactor containment vessel,

FIGURE 2 is a vertical section view through one of the door structures of this invention taken substantially along line 2—2 in FIGURE 1,

FIGURE 3 is a sectional view showing the door in elevation and taken substantially along line 3—3 in FIGURE 2,

FIGURE 4 is an enlarged fragmentary sectional view through the periphery of the door showing the sealing structure in sealing position,

FIGURE 5 is a fragmentary horizontal view through the door structure taken substantially along line 5—5 in FIGURE 3,

FIGURE 6 is a sectional view of one of the ratchets in the locking mechanism taken along line 6—6 in FIGURE 5, and

FIGURE 7 is a view similar to FIGURE 6 of another ratchet taken along line 7—7 in FIGURE 5.

The personnel and material lock, in order to be effective, should be sufficiently large to pass material handling vehicles commonly employed in handling bulky materials. The door of the present invention may be constructed quite large and in the form illustrated in the drawings, the door is approximately 8 ft. high by 5 ft. wide. As illustrated in FIGURE 1, the large spherical containment vessel **10** has a material lock tunnel **11** of cylindrical form piercing the sphere at line of intersection **12**. Ordinarily, the lock tunnel is provided with a pair of door closures spaced apart. One such door structure **13** is near the outer end of the tunnel and another door structure **14** is spaced inwardly along the tunnel therefrom. The lock is provided with two doors for the purpose of containing

within the vessel **10** any gases or airborne particles which should not be allowed to escape to the outside in quantity. At the same time, the two door structures permit removal of personnel from the vessel under adverse conditions.

The door structure of this invention is particularly suited for incorporation into lock tunnels, since the door is provided with its own frame and cylindrical section which may be welded directly into the tunnel. Each of the door structures is provided with its own reinforcing so that no additional work need be done on the door section except to incorporate it into the tunnel.

The door structure itself is best illustrated in FIGURES 2, 3 and 5.

The door is constructed as a complete section which may be placed in a lock tunnel as a unit. The section has an outer metal shell or frame **15** for the door which is generally rectangular with rounded corners, such as illustrated at **16** and **17** in FIGURE 3, so that it may mate for butt welding with the tunnel structure **11**. Stiffeners are provided around the outer shell since the latter may be formed of structural plates. Stiffeners **18** and **19** are illustrated as angle members bent to conform with the shell shape and welded or otherwise secured to the outer surface of the shell. An outstanding plate stiffener **20** is similarly provided on the section and may form an abutting surface against which insulating material might be stacked, if desired, as illustrated at **21** and **22** in FIGURE 5.

The frame for the door is formed in part by a wall **23** which may have a double thickness including a portion **24** as illustrated in FIGURE 5. The stiffener **20** actually forms an extension of the plate **24**. This wall is interrupted by a heavier metal plate liner **25** which defines the opening through the door section. It will be noted that the door is intended to close within the opening and seal against the heavier plate liner **25**. In FIGURE 3 it will be noted that the liner **25** and door **26** have correspondingly similar shapes and the liner is normal to the partition wall so as to present a relatively wide inwardly directed face. The construction is so made that the door will have a slight peripheral clearance with the plate liner about its entire periphery when the door is in its closed position.

The door **26** is of a box frame construction and includes face plates **27** and **28** supported by a number of spacing stiffeners **29**. The door is made gas tight and any opening through the door for accommodating a shaft or the like is provided with appropriate seals. The door is supported entirely by a pair of hinges including hinge plates **30** welded to the partition or wall plate **23** and a second hinge part **31** welded to the door plate **28**. The hinge pin **32** connects these parts so that the door swings about the pins located to one side of the door itself. This permits the door to swing into the opening defined by the plate liner **25** until it comes to rest against a rubber bumper **33** on the side of the door opposite the hinges.

The periphery of the door is formed with a well having a bottom plate **34** shaped to the generally rectangular form of the door including the rounded corners. A rubber inflatable seal **35** is seated against the plate **34** and held in place by a pair of retaining blocks **36**, one on either side of the door. The form of the inflatable seal is best illustrated in FIGURE 4 wherein it will be noted that the seal has flange portions **37** into which a canvas duck or webbing reinforcing **38** extends as it reinforces the entire width of the seal member. A medial enlarged section **39** of the seal is formed with an internal passage or split **40** made during the molding process. A metal foil sheet **41** may be inserted in the mold in order that the rubber of the seal will not adhere to itself over the area of the foil. This permits the installation of an air seal inflating nipple **42** connecting with the space so that the seal may be inflated. The seal member is generally formed in a straight mold

and the opposite ends brought together and vulcanized to form a seal shaped to the periphery of the door.

In operation, the door of the present invention is automatically sealed in the opening provided by the liner 25 when the locking mechanism of the door is actuated. Hand wheels 44 and 45 extend through the door for the purpose of permitting locking and unlocking from either side. As best illustrated in FIGURE 3, the hand wheels operate a gear system 46 connected by similar links 47 to respective locking bars 48 and 49. Generally, one complete turn of the hand wheel is sufficient to lock or unlock the door. The locking bars are received in reinforced receptacles 50 and 51 formed in the frame of the door section and they slide through guide sleeves 52 and 53 welded to the inner portion of the door. A hose 54 fastened to the door and having a flexible section 55 may lead by piping 56 (FIGURE 5) from a supply of gas, such as nitrogen, to a 3-way valve 57 mounted near the locking bar 49. The valve is provided with a vent 58*a* and a connection 58 leading to the nipple 42 into the seal proper. As the locking bar is moved toward locking position, a detent 59 will strike the valve operator 60 admitting nitrogen into the seal to inflate it. This will move the outer portion of the seal to the dotted line position 35*a* shown in FIGURE 4. The pressure creates a good seal with the plate liner 25 and also forces the seal material inwardly against the retaining plate 34 at the base of the well in the door. The clearance between the door and its opening is thus completely sealed since the inflatable seal is continuous about the door.

Certain safe guards are provided in the lock structure to prevent the simultaneous unlocking of both doors in the event of a disaster. The locking pawls illustrated in FIGURES 6 and 7 are part of the mechanism for this purpose. Each door is provided with a ratchet B which will turn in the direction of arrow 61 for locking the door. A pawl 62 is operated by the spring loaded detent 63 (FIGURE 3) and through a control cable 64 to the pawl preventing the locking of the door mechanism except when the door is in closed position. Pawl 62 is normally against ratchet B and only when the detent 63 strikes the door frame will the pawl be retracted permitting the mechanism to be turned for locking the door. Such mechanism is, of course, provided on both doors 13 and 14.

Ratchet A may be turned in the direction of arrow 65 for unlocking the door. As soon as one door mechanism is operated to withdraw its locking bars, a finger mechanism 66 will be tripped by a finger 67 so as to engage pawl 68 on ratchet A. Thus, when one door is unlocked the adjoining door is prevented from being unlocked by the pawl 68 on the ratchet A. It will thus be seen that where two doors such as 13 and 14 are used in a lock structure, the present mechanism may easily be employed to prevent both doors from being opened at the same time, accidentally.

An additional pawl 69 illustrated in FIGURE 6 may be controlled by a pressure differential cylinder (not shown) and may engage ratchet A to prevent opening of the door so long as a lesser pressure exists on the reactor side of the door. The portion 70 of the ratchet which is free of teeth will permit sufficient movement of the locking mechanism for deflating the seal allowing pressure equalization through the gap surrounding the door.

The door of the present invention may be equipped with other appurtenances such as the observation window 71 or other means for detecting the condition on either side of the door.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, for some modifications will be obvious to those skilled in the art.

We claim:

1. In a door section having a door member provided with a peripheral well, a seal member comprising a continuous rubber-like annulus having a base seated against the bottom of said well, said annulus being reinforced with webbing preventing distortion in an annular direction and having a central enlarged portion internally provided with a passage for inflating fluid and extending outwardly from the base to substantial alignment with the door periphery.

2. In a lock-chamber having a tunnel and a pair of doors in the tunnel at spaced portions thereof each movable alternatively to a closed position to close sealingly said tunnel at each of said portions and to an open position to open the same, means maintaining a predetermined relationship of the door positions, comprising: first lock means on one door operable alternatively to lock said door in a closed position and to unlock the same; second lock means on the other door operable alternatively to lock said other door in a closed position and to unlock the same; and means operable by said first lock means to preclude unlocking operation of the second lock means whenever said first lock means is not locking said one door in the closed position.

3. In a lock-chamber having a tunnel and a pair of doors in the tunnel at spaced portions thereof each movable alternately to a closed position to close sealingly said tunnel at each of said portions and to an open position to open the same, means maintaining a predetermined relationship of the door positions, comprising: first lock means on one door operable alternatively to lock said door in a closed position and to unlock the same; second lock means on the other door operable alternatively to lock said other door in a closed position and to unlock the same; means operable by said first lock means to preclude unlocking operation of the second lock means whenever said first lock means is not locking said one door in the closed position; and means operable by said second lock means to preclude operation of the first lock means whenever said second lock means is not locking said other door in the closed position.

4. In a lock-chamber having a tunnel and a pair of doors in the tunnel at spaced portions thereof and movable alternatively to a closed position to close sealingly said tunnel at each of said portions and to an open position to open the same, means maintaining a predetermined relationship of the door positions, comprising: first lock means on one door operable alternatively to lock said door in a closed position and to unlock the same; second lock means on the other door operable alternatively to lock said other door in a closed position and to unlock the same; means operable by said first lock means to preclude unlocking operation of the second lock means whenever said first lock means is in an unlocking arrangement; and means preventing the operation of said first lock means to a locking arrangement except when said one door is in the closed position.

5. In a lock-chamber having a tunnel and a pair of doors in the tunnel at spaced portions thereof each movable alternatively to a closed position to close sealingly said tunnel at each of said portions, means maintaining a predetermined relationship of the door positions, comprising: first lock means on a first door operable alternatively to lock said door in a closed position and to unlock the same; second lock means on the other door operable alternatively to lock said other door in a closed position and to unlock the same; means operable by said first lock means to preclude unlocking operation of the second lock means whenever said first lock means is in an unlocking arrangement; means operable by said second lock means to preclude operation of the first lock means whenever said second lock means is in an unlocking arrangement; means preventing the operation of said first lock means to a locking arrangement except when said one door is in the closed position; and means preventing the operation of said second lock means to a locking arrangement except when said other door is in the closed position.

6. In a lock-chamber having a wall means defining a tunnel and a pair of doors removably in the tunnel at

spaced portions thereof each movable alternatively to a closed position to close sealingly said tunnel at each of said portions, means maintaining a predetermined relationship of the door positions, comprising: first lock means on one door operable alternatively to lock said door in a closed position and to unlock the same; second lock means on the other door operable alternatively to lock said other door in a closed position and to unlock the same; means operable by said first lock means to preclude unlocking operation of the second lock means whenever said first lock means is not locking said one door in a closed position, seal means mounted on the one door extending into sealing engagement with the wall means of the tunnel when the one door is in the closed position; and means precluding unlocking operation of the second lock means whenever said seal means is not extended into sealing engagement with the wall means.

7. In a lock-chamber having a wall means defining a tunnel and a pair of doors in the tunnel at spaced portions thereof each movable alternatively to a closed position to close sealingly said tunnel at each of said portions, means maintaining a predetermined relationship of the door positions, comprising: first lock means on one door operable alternatively to lock said door in a closed positin and to unlock the same; second lock means on the other door operable alternatively to lock said other door in a closed position and to unlock the same; individual seal means mounted on each door extendible into sealing engagement with the wall means of the tunnel when the door is in a closed position; means operable by said first lock means to preclude unlocking operation of the second lock means whenever said first lock means is not locking said one door in a closed position; and means effecting extension of each seal means only when the lock means of the door on which the seal means is mounted is locking the door in a closed position.

8. In a lock-chamber having a wall means defining a tunnel and a pair of doors in the tunnel at spaced portions thereof each movable alternatively to a closed position to close sealingly said tunnel at each of said positions, means maintaining a predetermined relationship of the door positions, comprising: first lock means on one door operable alternatively to lock said door in a closed position and to unlock the same; second lock means on the other door operable alternatively to lock said other door in a closed position and to unlock the same, said second lock means including a rotatable operating means having a ratchet movable therewith and a pawl biased to lock the ratchet and prevent rotation of the operating means; and means operable by said first lock means to permit operation of the second lock means only when said first lock means is locking said one door in the closed position including a finger on the first lock means and a connecting means operable by engagement of said finger therewith to release said pawl from said ratchet.

9. The device of claim 7 including individual seal means mounted on each door expandable by controlled pressure into sealing engagement with the wall means of the tunnel when the door is in the closed position, and means for effecting extension of each seal means only when the lock means of the door on which the seal means is mounted is locking the door in the closed position, including a detent on the last mentioned lock means, a pressure system communicating with the seal means, and a control in said system engaged by the detent to cause pressure to be applied to said seal means.

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