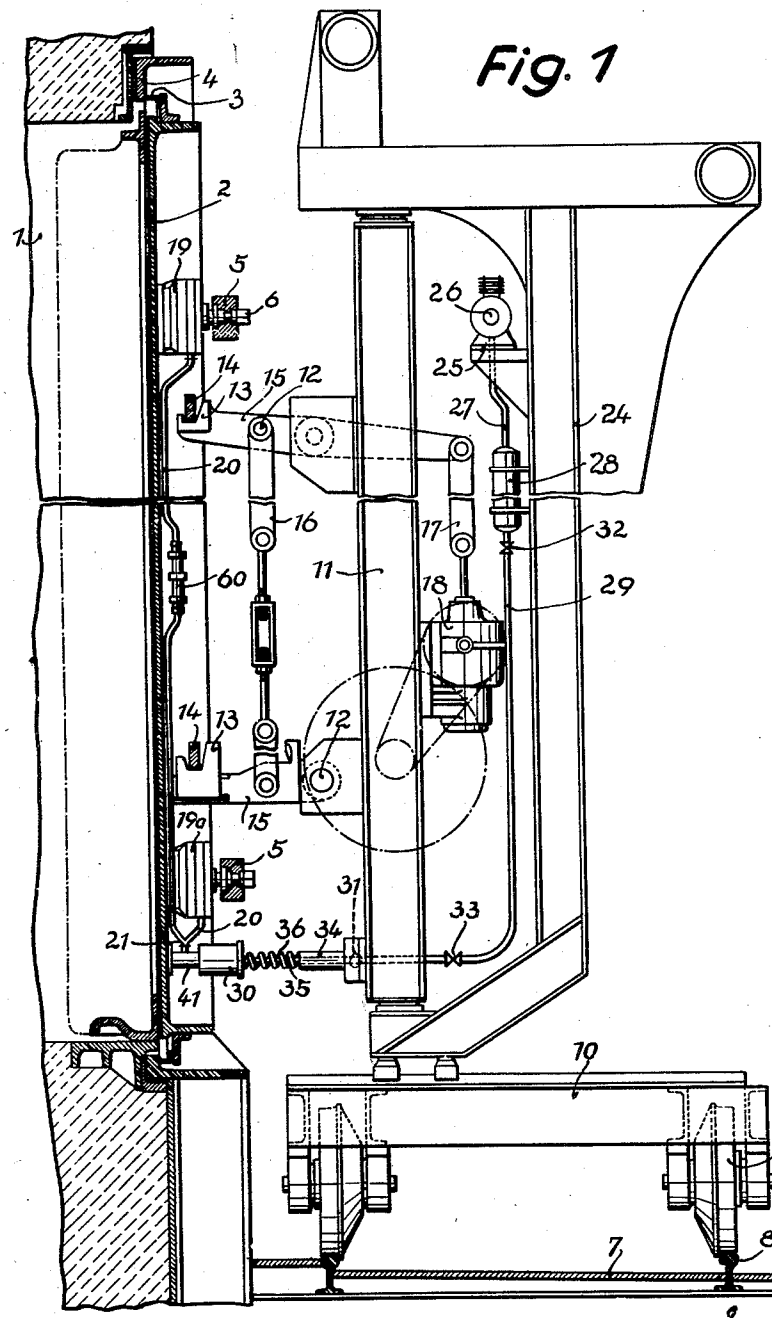
Nov. 27, 1956 F. DOLL 2,772,226

COKE OVEN DOOR

Filed April 25, 1952 2 Sheets-Sheet 1

Fig. 1



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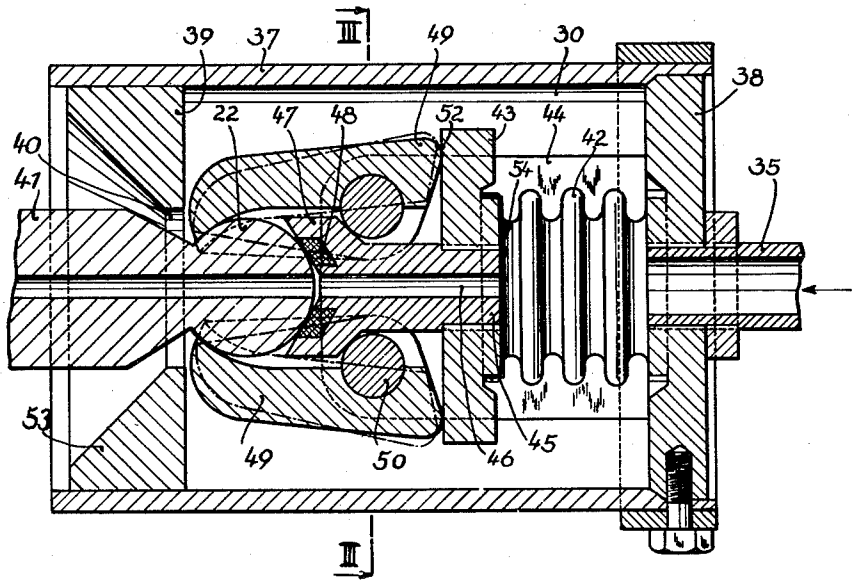


Fig.2

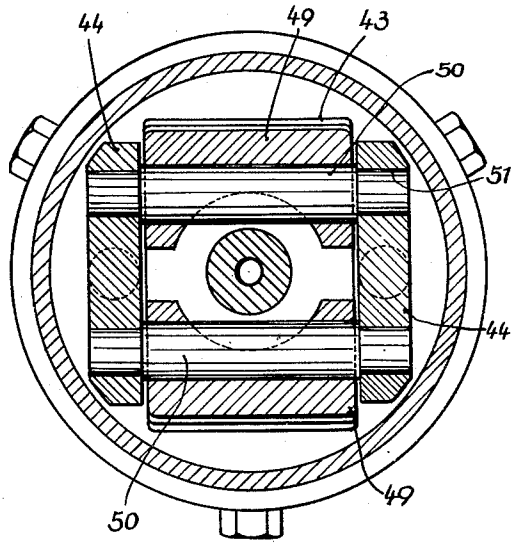


Fig.3

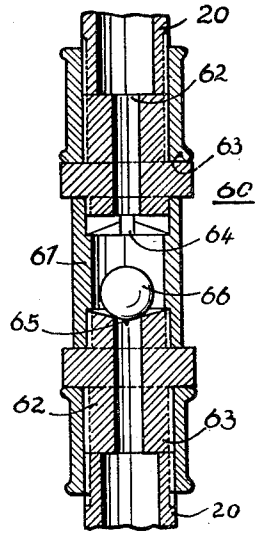


Fig.4

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COKE OVEN DOOR

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Application April 25, 1952, Serial No. 284,281

8 Claims. (Cl. 202—248)

The present invention relates to means for producing or controlling the closure pressure exerted on coke oven doors or the like through latching means by a gaseous or liquid pressure medium.

To obtain a proper sealing of the different doors of coke ovens it is necessary to individually apply the sealing ribs, flanges or the like of each door against the door frame of the oven mouth of the individual oven chambers with a pressure which invariably remains uniform on each resealing of the oven doorway, the sealing pressure of which varies from chamber to chamber and so must be individualized to the oven chambers because they are integral compartments of a battery. In addition to the usual latching of the door of each oven chamber individually by rotation of bolts carrying the latches, whereby these latches are individually applied against hooks individually connected to the masonry of the oven, means also have been furnished for producing the uniform pressure through the agency of springs disposed between the door and the latches. In such spring sealing arrangements it is necessary, when the door of each chamber is to be unfastened, first to compress the individual oven chamber closure springs somewhat so that the latches individual thereto can be moved away from their hooks which are seated in the masonry against which the door seats. This compression of the springs for unsealing can be effected by a gaseous or liquid pressure medium which acts on the springs, through a diaphragm or a piston, until the latches of the ovens have been individually pivoted.

It has, furthermore, been proposed to set up the uniform closure pressure for sealing the doors by a gaseous or liquid pressure medium acting continuously against the door.

It is an object of the present invention to produce an automatic, and sealed coupling of the pressure medium connection to latching means of the form in which the required uniform closure pressure for such individual oven chamber doors, is produced by a compression device operated by a gaseous or liquid pressure medium.

A further object of the invention relates to a device operable with those oven doors where the closure pressure is produced by compression springs arranged between the door latches and door body, and is aimed at compressing the springs, to relieve the closure pressure, by means of a device to be operated by fluid pressure and that is effective for automatically coupling the pressure fluid connection to the latching means in fluidtight fashion, thereby rendering it unnecessary to have pipes with unions for each oven door arranged along the oven battery.

In fulfilment of these objects, the present invention provides for the arrangement of the source of fluid pressure that is to operate the latches on the door-handling mechanism, which is conventionally adapted to be driven in front of the oven battery, and in the form of a pressure-generating device which is adapted to be connected with

the latching means of the respective coke oven doors by pipe coupling means. In a preferred arrangement one pipe coupling only is provided for jointly serving the two latch-controlling devices of a door.

In accordance with a further feature of this invention, the pipe coupling is such that when the door handling mechanism is moved in the axial direction of the oven against the door of the latter and door-lifting claws of the handling mechanism engage lugs on the door for lifting the same, a coupling component on a pipe conduit on the door machine and connected to the pressure-generating device coacts automatically with another coupling component on a conduit means on the door and leading to the latching means, thereby to complete the make-up of the pipe-coupling from the pressure generating device to the latching means of the door.

To ensure a positive engagement of the coacting coupling components, even if not properly in register initially by the act of spotting the door machine, the component associated with the door handling mechanism is advantageously mounted on the latter by a form of cardan joint, for example by forming such a universal joint at the end of a part of a pipe section which is in turn connected to a pipe leading from the pressure-generating device and to the coupling component in question. Preferably one of the components has a conical or spherical head whilst the other component is correspondingly formed with a conical guideway.

In pursuance of a further feature of the invention one of the components of the automatic pipe coupling includes a connection piece having therethrough a passageway of small cross-sectional area and a bellows of larger cross-section connected with this passageway and with the piping connected to the pressure generating device.

The coupling is then such that, when the two components are abutted together, the fluid pressure medium exerts, through the bellows, a pressure in opposite direction on an annular surface of the connection piece and another part of the coupling component on the door machine to maintain the abutting faces of the coupling components in sealed interengagement.

By still another feature of the present invention, this continuous pressure of one coupling component against the other can be further ensured by arranging for the pressure exerted on the connection piece of the one coupling component to be simultaneously applied to claws which surround the conical or spherical head on the other component and exert a pull thereon in the opposite direction towards the point of junction.

By a still further feature of this invention the pressure-generating device on the door-handling mechanism comprises a compressor which is connected to an automatically-filling pressure accumulator. By this means the pressure generating device is always primed for operation at any time, so that it is only necessary for the operator to open a control cock to bring the means of this invention into operating effect.

It is usual, when a coke oven door of the kind with which this invention is concerned is mounted in position in the oven door opening, to close the lower latching device first, followed by the closure of the second upper latching device, in establishing the required closure pressure. This sequence of operation of the latching devices is of advantage in that it enables the necessary contact pressure to be obtained with certainty at the lower part of the door without excessive effort, and avoids unnecessary straining of the sealing means around the door perimeter. A further feature of the present invention resides in constructing and arranging the means for producing the closure pressure in such a way that the lower latching device is automatically operated first, followed by the subsequent operation of the upper latching device.

As applied to means for producing the closure pressure of the coke oven door in which the pressure medium acts on the latching device as the sealing force during the time that the door is closed, this feature is carried into effect by arranging in the pressure medium conduit between the upper and lower latching devices a pressure delay valve which is so constructed that, when latching takes place, the pressure medium first passes to the lower device and only gradually to the upper latching device.

This feature can correspondingly be carried into effect in the case of apparatus in which the closure pressure is exerted by force of spring means and the pressure fluid is used to relieve this spring pressure for unlatching purposes. In this event, the pressure delay valve incorporated in the pressure medium conduit between the upper and lower latching devices is so constructed that, when latching takes place, the pressure medium is first exhausted from the lower latching device and only gradually from the upper device.

The pressure delay valve referred to may, for example, comprise a throttle member (for example a ball) and this member, and/or at least one fluid flow opening against which it is adapted to be pressed, be recessed so as to allow the passage of a greater quantity of pressure medium in one direction of flow than in the opposite direction.

The interspace for passing an appropriate quantity of pressure medium per unit time can be formed in the pressure delay valve by a recess or recesses at the inflow and/or outflow openings or ports. It is also possible, however, to furnish such recesses in the throttle member, for example when the latter is in the form of a piston.

A preferred embodiment of the invention is illustrated in the accompanying drawings, in which,

Figure 1 is a vertical section through the door-closed end of a coke oven chamber illustrating the door handling mechanism arranged in front of the same.

Figure 2 is an enlarged longitudinal section through the pipe coupling employed.

Figure 3 is a cross section through the coupling taken on the line III—III of Figure 2.

Figure 4 is an enlarged illustration of a pressure controlling valve which is advantageously used in this invention.

As will be observed from Figure 1, the end of the oven chamber is denoted **1**, and a door **2** is seen inserted therein with its sealing flange **3** pressed against the door frame **4** surrounding the door opening in the oven chamber.

Closure pressure against the door frame **4** is applied by means of latches **5** disposed at the upper and lower parts of the door and each pivotally mounted on a latch bolt **6**. In the closed position of the door, the latches **5** are engaged behind hooks (not shown in the drawing) connected to the door frame **4**.

A door-handling mechanism generally denoted **10** is adapted to be propelled along the front of the oven battery, and for this purpose, as conventional, has wheels **9** running on rails **8** on the operating bench **7**. This door-handling mechanism **10** includes a vertical beam **11** carrying levers **15** which are mounted on pivots **12** on the beam and which are of claw-form at their door ends **13**.

With the parts arranged as illustrated in Figure 1, the claws **13** engage in lugs **14** on the door. The levers **15** are interconnected by a link and lever system **16** so as to be operable in unison from a driving means **18** through a lever **17**.

In the embodiment illustrated it is assumed that housings **19** and **19***a*, disposed between the body **2** of the door and the latches **5** contain closure springs which normally exert a uniform pressure against the body of the door and latches **5**. When, however, the door is to be released, this closure pressure has to be relieved by compression of the springs to permit pivoting of the latches **5**.

To this end diaphragms or pistons are arranged in each

housing and are arranged to be operable to take the spring pressure of the latches **5**, when they are operated by a pressure medium, for example, compressed air. Such compressed air diaphragms or pressure pistons are in communication with pipes **20** which are interconnected in a conduit **21** both of which are stationary on the door. Conduit **21** leads to a stationary coupling component or male part **41** secured to the metal plate of the door body **2**. As can be seen from Figure 2, the coupling part **41** has a head **22** of spherical formation, and a passage **23** of small cross-sectional area passes through the part **41**, and its head **22** and is dedicated to the throughflow of the pressure medium.

Arranged on a platform **25** of a further vertical beam **24** of the door-handling mechanism **10** is a compressor **26** which is connected through a pipe **27** with a compressed air container **28**. A pipe **29** leads from the compressed air container **28** to a but movable further coupling component or female part **30** which is connected by a form of cardan joint **31** to beam **11**. A pressure regulating valve **32** and a three-way cock **33** are arranged in the pipe **29**, and connection between the cardan joint **31** and the female coupling part **30** is made by a pipe **35** which is surrounded by a spring **36**, guided in a cylinder **34**, serving to hold the coupling part **30** properly centered.

As is apparent from Figures 2 and 3, the movable coupling part **30** comprises a cylindrical casing **37** closed at one end by a plate **38** having an opening for the insertion of the pipe **35**. At its other end the cylindrical casing **37** is furnished with a cover **39** having an opening **40** large enough to permit the passage therethrough of the spherical head **22** of the stationary coupling part **41**. The opening **40** is flared conically outwards to form a guideway. Connected fluid tightly to the closure plate **38** is a multiple diaphragm or bellows **42**, which, at its other end, is united in sealed fashion to a plate **43** by communication of bellows **42** with pipe **35**. This plate **43** is of rectangular shape and is located with its longitudinal edges between two plates **44** firmly connected to the cover **38**.

Screwed into the plate **43** is a connection conduit piece **45** having a small-diameter bore **46** and an enlarged end **47** for connecting passage **33** with bellows **42**. This end **47** of connection piece **45** forms the movable coupling end which bears against the head **22** of the other stationary coupling part **41**, and the connection piece **45** is provided with an inward depression of conical shape conforming to the spherical shape of the head **22**, and with a soft packing **48**, for example of rubber or the like.

Pivotally supported on bolts **50** between the two longitudinal plates **44** are claws **49** which are of semicircular shape in cross section, these bolts **50** passing through apertures **51** in the two plates **44**. The ends of the claws **49** are of such formation that when the coupling is made, they partly embrace the spherical head **22**. In the coupled condition the two claws **40** are disposed in the respective positions indicated in dotted lines by reason of the pressure exerted thereon by the expanded bellows **42** when pressure fluid is applied to line **35**.

Incorporated in the conduit **20** between the upper and lower latching housings or devices **19** and **19***a* is a pressure delay valve **60** which is seen in more particularity in Figure 4. This valve **60** comprises a cylindrical housing **61** in each end of which is screwed a threaded double nipple **62**. The corresponding pipe ends of conduit **20** are connected up to the double nipples with the aid of sleeves **63**. The lower end of the upper nipple **62** projecting into the housing **61** is furnished with recesses **64**, preferably arranged cross-wise. The upper end of the lower nipple **62** projecting into housing **61** has, in contrast, a single recess **65** of small depth.

Arranged within the housing **61** is a ball **66** of smaller diameter than the inner diameter of the housing. When the latch is unfastened, that is to say when compressed air is supplied to the two latching devices **19** and **19***a* for

the purpose of compressing the springs to release the latches, the ball **66** is forced upwards in housing **61**. The compressed air can, however, pass through the recesses **64** of larger depth, without substantial loss in pressure, and through conduit **20** to the upper latching device **19**, so that the compression of the closure springs of the two latching devices takes place practically simultaneously, or the springs of the lower latching device are compressed slightly in advance of those of the upper device.

When the door is latched, in order to exert pressure on the lower part of the door first, the compressed air must exhaust from the lower latching device **19***a* first. This is effected by opening of the three-way cock **33**. Thereupon the ball **66** is applied against the end of the lower nipple **62** which projects into the housing **61**, so that the compressed air present in the upper latching device **19** can only gradually escape through the recess **65** at the upper end of the lower nipple. By this means it is ensured that the compression spring of the lower latching device **19***a*, from which the compressed air exhausts rapidly, first of all exerts full pressure on the lower device **19***a*, followed subsequently by that full pressure from the springs of the upper latching device **19**.

In the case of latching devices in which the closure pressure is exerted force of a fluid pressure medium acting on the latching means during the period of closure of the door, the arrangement of recesses **64** and **65** in nipples **62** is correspondingly reversed, that is to say the compressed air must first be applied to the lower latching device **19***a* to produce the closure pressure, the ball **66** which serves as a throttle member or body being pressed against the nipple having the recess **65**, so that the supply of compressed air only takes place gradually to the upper latching device **19**.

When the oven door is to be removed, the door-handling mechanism **10** is driven before the oven chamber concerned of the battery containing it and, thereupon, the lifting means, including beams **24** and **11**, is propelled on its carrier frame in the direction of the oven axis towards the door **2**. The door raising claws **13** are brought into engagement with the door lugs **14** by starting up the drive means **18**. While this procedure is being carried out the head **47** of movable connection piece **45** is applied against the spherical head **22** of the stationary coupling part **41**, within casing **30**, as indicated in Figure 2 by the forward movement of the carrier frame **11**.

The three-way cock **33** is now opened, enabling compressed air to pass from container **28** through the coupling and the two pipe connections **20** to the latching-control devices **19**, **19***a*. The air pressure is so regulated by the valve **32** that the springs in the housings **19** are compressed to a certain degree releasing their pressure on the latches **5**. As a result the latches **5** are loosened and can be pivoted from their hooks.

Thereafter the three-way cock **33** can be closed to container **28**, thus opening the line to the coupling device to the atmosphere and thus enabling the compressed air to escape from the diaphragms or pistons in the latching devices **19**, **19***a* through the three-way cock to atmosphere. The door can then, after being raised, be withdrawn and orientated by means of the vertical beam **11**.

If, when the lifting means is applied against the oven door **2** the head **22** of the tubular coupling part **41** is not exactly centered relatively to the coupling part **45**, this spherical head **22** abuts against the conical surface **53** of cover **39** and tilts casing **37** about cardan joint **31** until head **22** is thereby guided into a centralised position against the head **47** of the connection piece **45** of the other coupling part.

When the cock **33** is opened to container **28** and compressed air flows through the passages **23** and **46** of the coupling part **41** and connection piece **45** respectively, such air exerts a pressure in the bellows **42** against the annular surface **54** between the bellows and the passage **46**. This pressure acts on the connection piece **45** to

apply the packing ring **48** of the latter inwardly against the conical coupling head **22**. In addition the pressure acts on the rounded edges **52** of the claw-form parts **49**, whereby the leading ends of these claws embracing the spherical coupling head **22** also serve to press force on the latter firmly outwardly in a direction against the packing **48** of connection piece **45**.

To produce the sealing pressure force in the latching-control devices **19**, **19***a* by compressed air only and through the agency of diaphragms or piston means arranged in these devices, a non-return valve or an additional cut-off member must be incorporated in or behind the coupling part **41** to hold the fluid pressure therein during door sealing until released again for removal of the door for discharge of coke from the rest of its oven chamber.

What I claim is:

1. Apparatus for sealing and unsealing coke oven doors comprising: a coke oven door having locking means in the form of two upper and lower latching devices for coaction with door-holding means and compression spring means individual thereto to exert the closure pressure, for exertion of closure pressure between the door and the door-holding means, and for release of said closure pressure for unlocking the door; separate fluid pressure-operated means operable on the respective latching devices for effecting spring compression operation of the same; a source of fluid pressure for actuating said fluid pressure-operated means; a coupling between the source of fluid pressure and the fluid pressure-operated means of both said latching devices, and a pressure delay valve to control the fluid flow to and from one of the fluid pressure-operated devices, said valve being so constructed that, when latching takes place, the pressure medium first exhausts from the fluid-pressure-operated device of the lower latching device and only gradually from that of the upper latching device, for the purpose of releasing the compression spring means to allow the same to seal the door.

2. Apparatus according to claim 1, characterised in that the pressure delay valve comprises a throttle member, and at least one fluid flow opening to allow the passage of a greater quantity of pressure medium in one direction of flow than in the opposite direction.

3. Apparatus for sealing and unsealing coke oven doors comprising: coke oven door having door machine-engaging means for engagement by a door machine for removal and replacement of the door relative to a seat therefor, locking means on said door for coaction with door holding means therefor for exertion of closure pressure between the door and the door holding means and for release of such closure pressure for unlocking of the door, fluid pressure-operated means on the locking means for effecting one of said operations of the latter relative to said door holding means, a door machine positionable in front of said door and having a door supporting member movable toward and from the door for engagement with the door machine engagement means on the door, a source of fluid pressure on the door machine for actuating the fluid pressure operated means of the locking means on the door and a coupling between the source of fluid pressure on the door machine and the fluid pressure operated means on the door comprising two separable component parts, one component part being stationarily mounted on the door and having a passage therethrough and a line connection therefrom to the fluid pressure operated device on the door, and the other component part being mounted on the movable door supporting member on the door machine and in position thereon to automatically abut, in fluid transfer relation, with the component part on the door, when the door supporting member on the door machine is in position to engage the door machine engaging means on the door, upon movement of the door supporting member toward the door, said other component part on the door machine having a passage therethrough to register with the passage in the component part

on the door, solely by said abutting relation, and having a line connection from its passage to the source of fluid pressure on said door machine, for supply of fluid pressure from said door machine to the passage in the component part on the door for delivery therefrom to the fluid pressure operated means for the locking means on the door.

4. A combination as claimed in claim 3, and in which one of said two separable component parts of the coupling is conically flared at one end thereof for reception of an entering cooperating member of the other component part to effect self centering of the two separable component parts when brought into abutting engagement.

5. A combination as claimed in claim 3, in which one of said two separable component parts includes a connection piece movable therein and having a small diameter passage therethrough, and a bellows passage of relatively large diameter connected to the small diameter passage, and both constituting a portion of the line conduit from the pressure source to the fluid pressure operated means on the door, when the two component parts of the coupling are brought into mutual abutment, said connection piece being movable into tighter sealing relation with the other component part by a counter pressure exerted on the connecting piece by expansion of the bellows by the pressure medium therein after the initial abutment of the two component parts.

6. A combination as claimed in claim 5, and which includes mechanical means in the component part containing the bellows arranged in said component part, to simultaneously transmit the pressure, exerted on the connection piece by the bellows, onto the other component part in a direction opposite the direction of abutting engagement of the connection piece with said other part.

7. A combination as claimed in claim 6, and in which said mechanical means comprises pivoted claws which surround and engage a curvilinear head on the leading end of the other coupling component part at a region to

oppose separation of the two component parts while under fluid pressure.

8. Apparatus for sealing and unsealing coke oven doors comprising: a coke oven door having locking means in the form of two upper and lower latching devices for coaction with door holding means, for exertion of closure pressure between the door and the door holding means, and for release of said closure pressure for unlocking the door; separate fluid pressure-operated means operable on the respective latching devices for effecting operation of the same; a source of fluid pressure for actuating said fluid pressure-operated means; a coupling between the source of fluid pressure and the fluid pressure-operated means of both said latching devices, and a pressure delay valve to control the fluid flow in a line to and from one of the fluid pressure operated means for each of said latching devices, said valve being one operable to pass the fluid pressure therethrough gradually to the upper latching device relative to the flow to the lower latching device so that the flow of fluid pressure reaches the lower latching device first.

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