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M. MASON

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THERMOCOUPLE WELL ASSEMBLY

Filed June 17, 1937

2 Sheets-Sheet 1

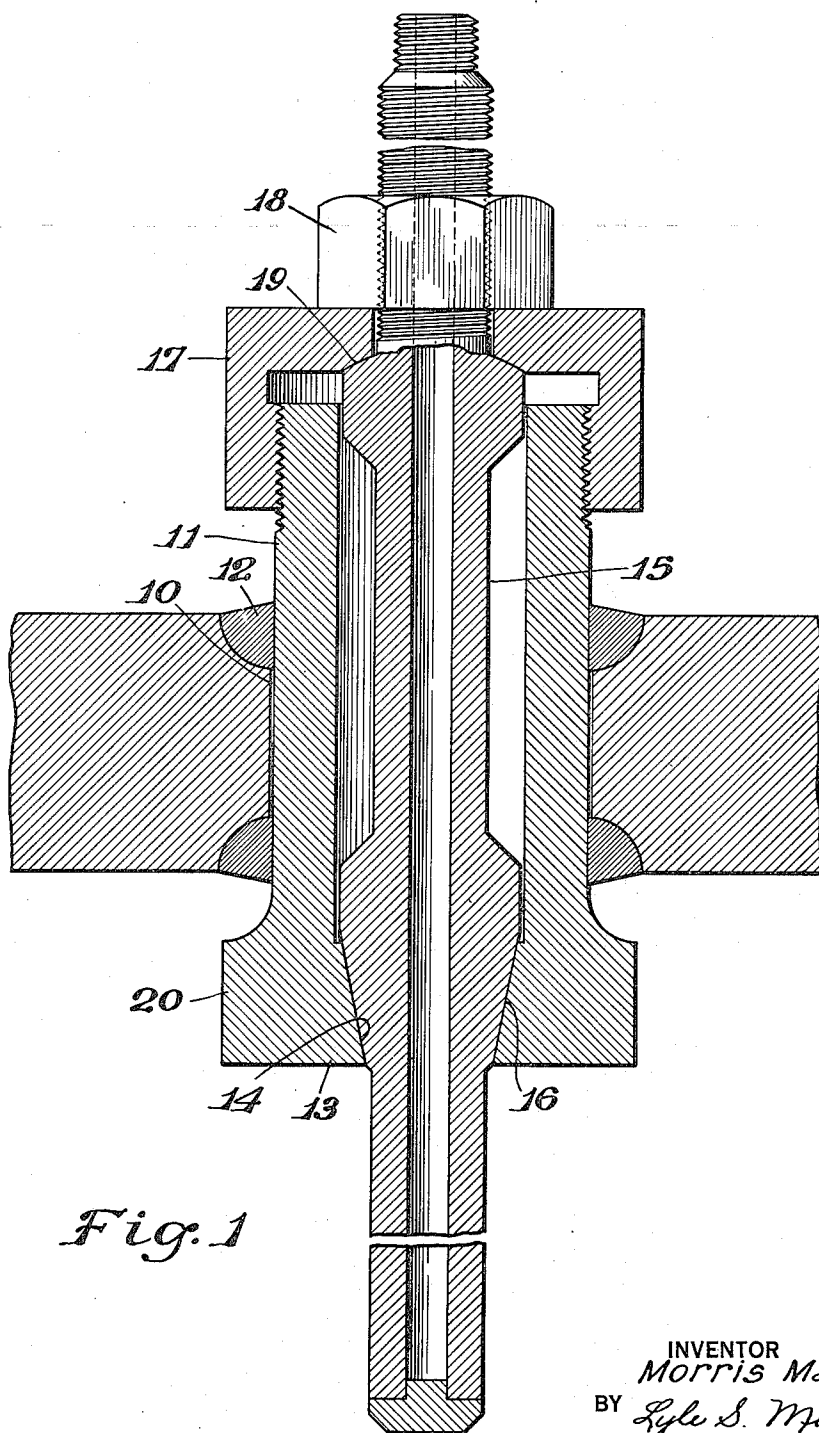


Fig. 1

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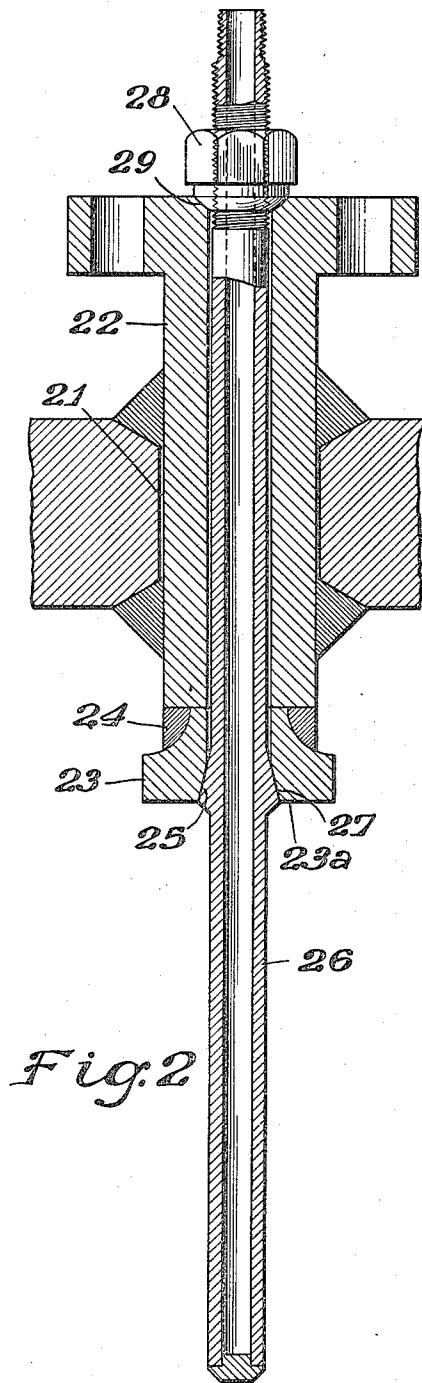
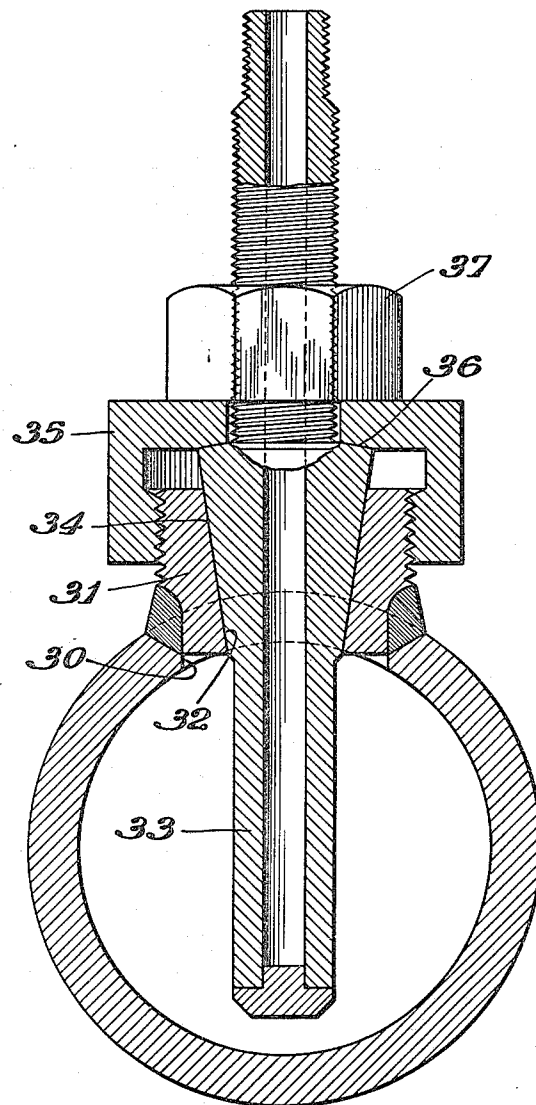
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THERMOCOUPLE WELL ASSEMBLY

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3 Claims. (Cl. 136—4)

This invention relates to the provision of normally closed readily accessible openings in the walls of metallic vessels and more particularly to an improved method of and apparatus for providing such openings with readily removable closures. More particularly it relates to thermocouples and thermocouple wells for pressure vessels, pipes, etc.

In metallic vessels employed in carrying out various industrial processes it is quite important that accessible openings through the wall of the vessel be provided for various purposes. Principal among the purposes for which such openings must be provided are the introduction and installation of pyrometer or thermocouple wells and the introduction of apparatus for measuring the wall thickness to determine, for example, the effect of corrosion. In this class of installation the consideration of ready removability is of extreme importance. In practicing methods heretofore known, great difficulty has been encountered in attempting to remove apparatus from openings in the walls of vessels where installed, due principally to sticking of the closure device to the opening in the vessel wall which it is designed to close normally. One of the principal causes of such sticking resides in faulty construction which results in permitting deposits from the process carried on within the vessel to gain access to the space between the periphery of the closure device and the surrounding wall of the opening which receives it. This condition has been found to be particularly aggravated in the heat treatment of hydrocarbons where tenacious carbon deposits which gain access to the space between these surfaces render removal of the closure means extremely difficult. In installations where this opening is normally closed by a pyrometer or thermocouple well and it becomes necessary to remove the well it has been found substantially impossible to effect this removal without breaking the well with the consequent result that the removal operation must be completed by driving the remaining broken portion of the well out of the opening with a punch.

In this connection it has also been found that the formation of openings in the wall of a vessel without reinforcing to compensate therefor has a decided weakening effect upon the vessel structure which becomes a factor of considerable importance where the process to be carried on within the vessel is conducted under pressure.

It is an object of the present invention to provide a method of and apparatus for establishing a normally closed readily accessible opening in

the wall of a vessel wherein the closure for the opening bears such a relationship to its seat that it is maintained free from sticking due to deposits from the process being carried on within the vessel and is thereby rendered easily and quickly removable without injury to the closure device.

It is a further object of the present invention to provide an improved method of and apparatus for establishing a normally closed readily accessible opening through the wall of a vessel which arrangement is free from sticking due to deposits from the process being carried on within the vessel and wherein a thermocouple well is employed as the closure means for the opening, thus giving to the well a dual function.

A still further object of the present invention lies in the provision of an improved method of and apparatus for installing a thermocouple well through an opening in the wall of a vessel wherein the relationship between the thermocouple well and the opening is such that deposits from the process being carried on within the vessel are prevented from gaining access between the outer periphery of the thermocouple well and the surrounding wall defining the receiving opening, to thus enable ready and quick removal of the thermocouple well without fracture thereto in case it is found necessary to remove the thermocouple well.

Certain preferred embodiments of my invention are illustrated in the accompanying drawings in which:

Figure 1 is a longitudinal cross-section view showing a thermocouple well mounted in the wall of a vessel in accordance with my invention, the vessel wall being broken away on each side.

Figure 2 is a longitudinal cross-section view showing a slightly modified arrangement of thermocouple well mounting.

Figure 3 is likewise a longitudinal cross-section view showing a still further modification of a thermocouple well mounting in the wall of a tubular conduit.

In practicing my invention an opening 10 is first formed in the wall of the vessel in any well known manner (Figure 1). A tubular member 11 of a sufficiently small outside diameter to be received in opening 10 is inserted therein and welded to the surrounding wall of the vessel as indicated at 12. The tubular member 11 extends a short distance into the vessel and is provided on its inner periphery adjacent the end 13 positioned on the inside of the vessel with a converging seat 14. The seat 14 is ground to provide a smooth surface. This operation is preferably

accomplished prior to the installation of the tubular member in the vessel wall. The tubular member 11 itself is usually formed by a turning operation on a lathe. Where this practice is followed the grinding and polishing operation is preferably carried out on the same machine.

A thermocouple well 15 is provided intermediate its ends with a shoulder 16 likewise ground and received in seat 14. It will be observed that both ground surfaces extend in sealed relationship to a point flush with the end 13 of the tubular member 11 thus rendering it impossible for deposits to gain access between these surfaces. Tubular member 11 has its outside end threaded to receive bonnet 17 which cooperates with the outer end of the thermocouple well 15 for holding the conical shoulder 16 tightly against its seat 14. The outer end of the thermocouple well 15 is provided with threaded nut 18 which serves normally to tighten the shoulder 19 of the thermocouple well against bonnet 17, to further effect a tight relationship of parts, but its important function is the retraction of the thermocouple well from its seat. This operation is effected by first turning nut 18 a small number of turns out of engagement with bonnet 17. Next bonnet 17 is turned likewise to remove it from engagement with shoulder 19, whereupon nut 18 is again tightened against bonnet 17 thus effecting withdrawal of the thermocouple well 15 out of its seat 14. I prefer to enlarge the portion of tubular member 11 lying on the inside of the vessel as indicated at 20, to give this end additional strength.

It will thus be seen that tubular member 11 serves three important functions: first, it has formed on the inner end thereof a ground seat for the reception of the ground shoulder of the thermocouple well; second, it functions to reinforce the vessel wall to compensate for the weakening effect due to the opening formed therein; and third, it serves to receive the fastening bonnet 17 for maintaining the thermocouple well in close contact with its seat as well as aiding in its removal.

In Figure 2 there is shown a somewhat modified adaptation of my invention. An opening 21 is formed in the vessel wall as in Figure 1 and tubular member 22 introduced therein and welded to the wall of the opening. Instead of forming the ground seat on the inner end of the tubular member, as in Figure 1, this seat is provided in an auxiliary tubular member 23 of slightly greater diameter than tubular member 22 to give the desired reinforcing. This auxiliary member is welded at 24 to the end of tubular member 22 and provided on its inner periphery with seat 25. This seat is diverged from a point removed from the end of member 23 to a point flush with the end surface 23a and ground to define a smooth seat. A thermocouple well 26 having a shoulder 27 formed intermediate its ends and provided with a ground surface is introduced into the tubular member from the inside of the vessel with the shoulder 27 received in engagement with the seat 25. The outer end of the thermocouple well 26 is threaded and receives nut 28 which engages the upper end 29 of tubular member 22 for holding the shoulder 27 of the thermocouple well 26 tightly against its seat 25. As in Figure 1 it is likewise apparent that the ground relationship between seat 25 and shoulder 27 prevents access between the surfaces of deposits from the process being conducted in the vessel, and hence renders the thermocouple well readily removable by loosening

the nut 28 and the exertion of a slight pressure upon the outside end of the thermocouple well.

In connection with Figure 2 it is to be noted that while I have shown the tubular member 22 with a flange on the outer end thereof, I may use a plain tubular member. I may likewise, under certain circumstances, form the ground divergent seat 25 on the inner end of tubular member 22 instead of employing separate member 23 and forming this seat therein.

In Figure 3 there is shown an arrangement for installing a thermocouple well in a tubular conduit in accordance with the teaching of my invention. An opening 30 is provided in the wall of the conduit of the tubular member as in the preceding modification and a relatively short tubular nipple 31 welded therein. A seat 32 is formed on the inner periphery of the tubular member 31 and provided with a ground surface. A thermocouple well 33 is provided intermediate its end with a shoulder 34, provided with a ground surface and is inserted in the tubular member 31 with the shoulder 34 in engagement with ground seat 32. The outer periphery of tubular member 31 is threaded and receives bonnet 35 which engages the rim 36 of shoulder 34 for holding the thermocouple well in place. The upper end of the thermocouple well 33 above rim 36 is threaded and receives nut 37 for engagement with the top of bonnet 35 to further effect a tight relationship of parts and to cooperate with the bonnet 35 in the manner described in connection with Figure 1 for effecting removal of the well 33. It will likewise appear that the ground seat 32 and ground shoulder 34 cooperating therewith converge at a point flush with the end of tubular member 31 adjacent the inside of the conduit as in the preceding modifications, thus preventing access between the surfaces of any material being conveyed through the conduit. The arrangement shown in Figure 3 is very much like that shown in Figure 1 differing therefrom principally in the fact that in Figure 3 tubular member 31 is not extended through the wall of the conduit and enlarged as is the tubular member 11 of Figure 1, this extra reinforcing not being necessary in most conduit installations.

While I have illustrated my invention as having particular application to the installation of thermocouple wells it will appear that the same has considerable utility where it is desired merely to provide a readily removable plug in the wall of the vessel. Such would be the case where it is desired to gain ready access through the wall of a vessel to measure the wall thickness as by introducing a micrometer device through the opening. While I have shown the nipples in which the ground seats are formed as being extended into the opening formed in the wall of the vessel it is to be understood that in many cases a sufficient reinforcing effect may be obtained by welding the tubular member about the opening in the vessel wall without extending it into the opening. Likewise while the seats are all shown as conical it will appear that a ball and socket type of seat would be applicable as well as other forms.

While I have described my invention in connection with certain specific embodiments thereof it is to be understood that these are by way of illustration rather than by way of limitation and I do not mean to be limited thereby except as indicated by the appended claims which should be construed as broadly as the prior art will permit.

I claim:

1. A closure for an opening in a vessel comprising, in combination, a tubular member secured about said opening provided internally at
5 its lower end with a conical seat and projecting externally of said vessel, said tubular member being provided on its externally projecting end with screw threads; closure means extending through said tubular member and extending be-
10 yond said tubular member externally of said vessel, said closure means having a conical seat adapted to cooperate with said first-mentioned conical seat, and equipped at its external end with screw threads, said closure means being
15 equipped with a shoulder between said conical seat and said last-mentioned screw threads; a bonnet having screw threads adapted to cooper-

ate with the screw threads on said tubular member and a seat portion adapted to cooperate with said shoulder, said bonnet thus acting to hold said closure means in place within said tubular member, with said conical seats in contact with
5 each other to prevent entry of any material present in said vessel into said tubular member; and means adapted to cooperate with the screw threads on said closure means and with said bon-
10 net to disengage said conical seats.

2. A closure according to claim 1 in which the closure means comprises a thermocouple well.

3. A closure according to claim 1 in which the means to cooperate with the screw threads on the closure means and the bonnet comprises a screw
15 nut.

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