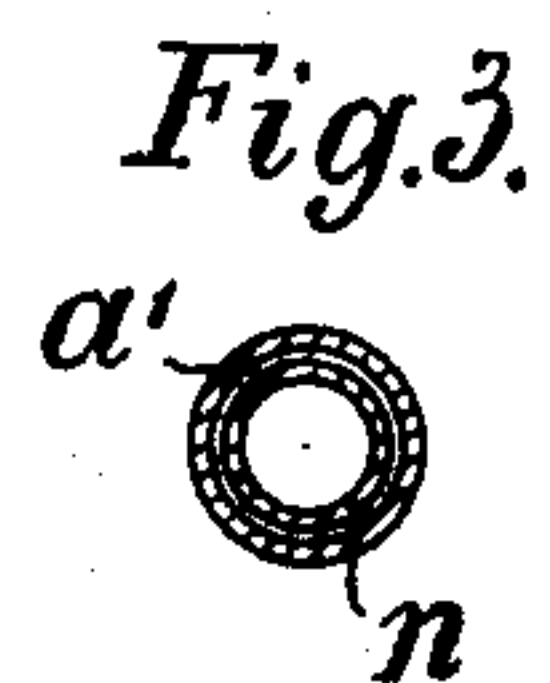
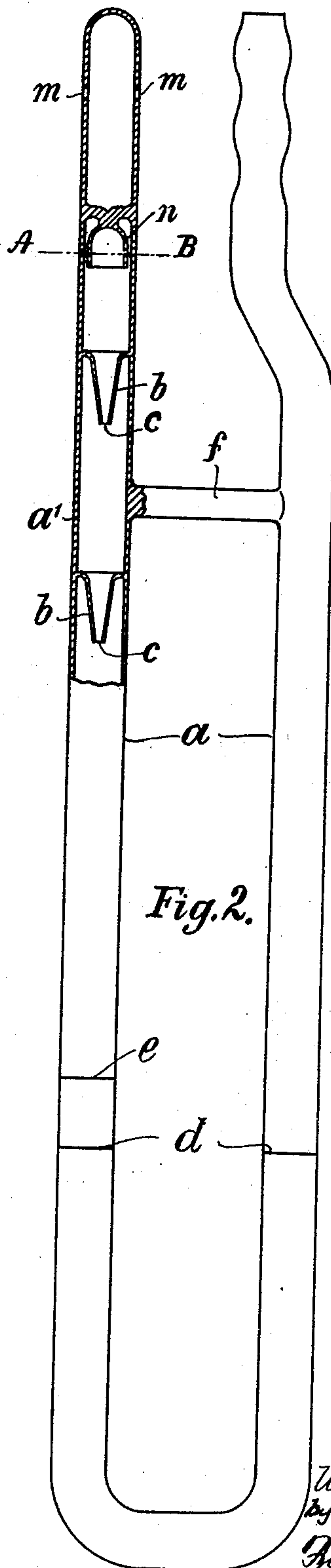
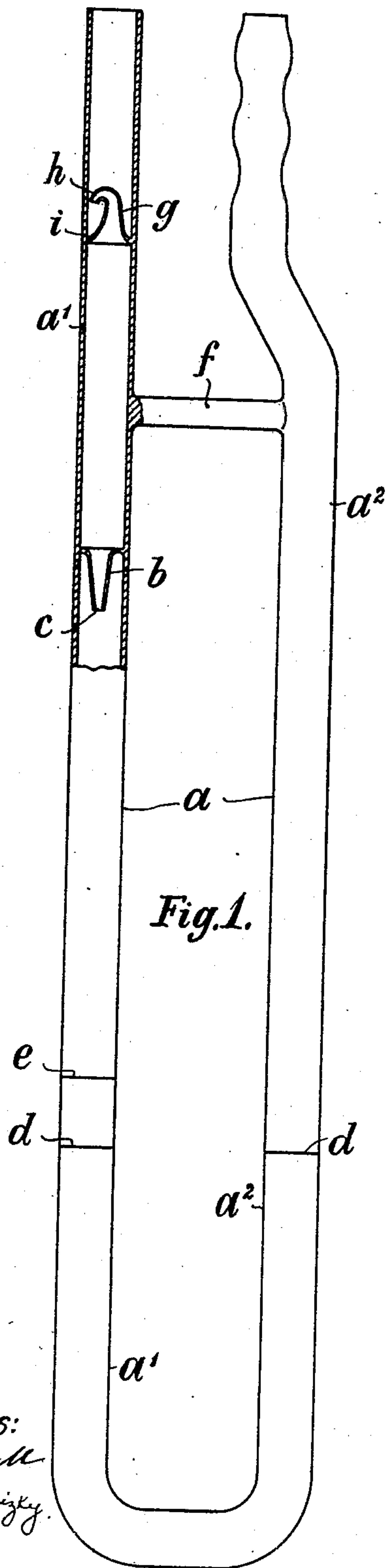


W. LAZARUS.  
 QUICKSILVER CLOSURE FOR FERMENTATION VESSELS.  
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WITNESSES:  
 Hugo Correll  
 Sally G. Yundizky.

INVENTOR:  
 Willy Lazarus.  
 BY ATTORNEY:  
 Fred P. Schuch.



# UNITED STATES PATENT OFFICE.

WILLY LAZARUS, OF KIEL, GERMANY.

## QUICKSILVER-CLOSURE FOR FERMENTATION VESSELS.

No. 912,581.

Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, WILLY LAZARUS, a citizen of Germany, residing at Kiel, Germany, have invented new and useful Improvements in Quicksilver-Closures for Fermentation Vessels, of which the following is a specification.

In devices for closing fermentation vessels by means of mercury it is well known that there is danger that in the case of sudden powerful development of gases in the barrel or vessel to which the closing device has been applied, the quicksilver may be blown out. In order to prevent this, various devices have been already invented, which devices may be divided into three main groups. In the first group the tube containing the quicksilver is provided at one or more points lying within the normal position of the quicksilver, with constrictions or the like, which are intended to restrain the motions of the quicksilver. Experience has, however, proved that those devices are completely inoperative, and on this account they are actually no longer used in practice. The second group provides baffles within the normal position of the quicksilver, which baffles have the double purpose of forcing the ascending current of gas by multiple turns out of its straight direction, and also to divide the quicksilver into a quiescent and a moving column, which columns are connected together in such a manner that only that column which is provided with the baffles is penetrated by the gas. These devices are the kind which have hitherto been most in use. The inventor will not judge how far they fulfil their purpose, but it is obvious that they are all very complicated. In consequence thereof they are very expensive and moreover it is impossible to construct them entirely of glass, and they are actually made of celluloid or vulcanite. These materials, however, possess the very serious drawback that the quicksilver which is in constant motion in them is rapidly fouled and consequently the parts in contact with it are soon covered with a gray deposit. Such devices must consequently be frequently cleaned, which moreover in view of the fact that for celluloid and vulcanite only cold or at any rate luke warm water can be used, is only partially effective and moreover very troublesome. If, how-

ever, the cleansing is not frequently done, then the quicksilver deposit soon chokes the apparatus and makes it unserviceable. The third group of these devices possesses within the normal position of the quicksilver no baffles, but on the other hand has above the same a very considerably increased diameter of the tube. The idea at the base of these devices is obviously that the level of the quicksilver on reaching the widening will no longer rise so quickly because of the very considerable increase in area. It is, however, overlooked in this construction that precisely this widening of the section area reduces greatly the effective height of the quicksilver column and equally the pressure exercised by it, and that consequently large quantities of the gases are liberated in the fermentation vessel, which ejects the entire quicksilver out of the closing device. Experiments have proved that this cannot be prevented by the device of fixing a funnel above the widening, the downwardly curved end of which is provided with a narrow opening.

The closing device according to the present invention is free from the above mentioned drawbacks and is at the same time of such simplicity that it can be constructed entirely of glass, whereby the fouling of the quicksilver is avoided. The invention is based upon a discovery made by the inventor which appears to have been hitherto unknown, the application of which moreover to the device of quicksilver closures is absolutely new. If gases or liquids are allowed to flow through a tube having a funnel-shaped insertion, and the resistance which the funnel opposes to these two different media on the flow in one and in the other direction be examined, the following surprising result is attained, namely, that with gases the resistance is greater when these pass through the funnel in the direction from its base to its point, than in the opposite direction. In the case of liquids, however, the resistance is exactly reversed, being smaller when these pass through the funnel in the direction from the base towards the point, than in the opposite direction. Applying this discovery to the present case in which we have to do with a stream of carbonic acid moving upwards and with a column of quicksilver moving in the same direc-



tion, it results that a funnel with its point turned downwards will only offer to the carbonic acid a relatively small resistance while to the quicksilver it will offer a very considerable resistance. In other words the carbonic acid can pass through almost unopposed while the quicksilver will be very powerfully held back. This is obviously exactly the purpose which is aimed at in all quicksilver closures.

The new quicksilver closure consists of a U-shaped bent tube in the ascending limb of which, which is throughout of the same width and has no outer projections, clips or the like, there are arranged only above the normal quicksilver position one or more funnels. Their points, each provided with a narrow opening, are turned downwards and lie in the tube axis so that the quicksilver, when there is a powerful development of gas, must pass through them in a thin and weak stream. The downwardly directed funnel or funnels must not be placed in the normal quicksilver position, because they would in this position divide the quicksilver during its up and down motion. The consequence of this would be a sudden diminution of the effective height of the quicksilver column, which in turn would bring about the sudden liberation of large quantities of gas in the fermenting vessel.

In the accompanying drawing Figure 1 shows one, and Figs. 2, 3 another form of the new apparatus, Fig. 3 being a section on line A—B of Fig. 2.

The construction illustrated in Fig. 1 consists of a U-form bent tube *a* having two limbs *a'* and *a''*. The ascending limb *a'* is open at the top while the descending limb *a''* is connected in the usual manner by means of a flexible tube or pipe (not shown) to the barrel (also not shown) and containing the fermenting liquid. The two limbs *a'* and *a''* are connected together by a crossbar *f* for the sake of increased strength. In the lower bent part of the tube *a* is placed the quicksilver *d* in quantity corresponding to the required pressure. In the ascending limb *a'* is arranged at a little distance above the point to which the quicksilver during normal fermentation ascends when the carbonic acid is escaping, the funnel *b* having its point directed downwards and provided with the central aperture *c*. During normal fermentation the quicksilver never reaches up to the funnel *b*. If nevertheless powerful escapes of gas take place, then the quicksilver is forced to flow through the funnel in a thin and weak stream whereby the larger proportion of the energy imparted to it is taken away.

For pressures of about 0.3 atmosphere and upwards one funnel *b* suffices, while in the case of lower pressures two or more such

funnels are provided, because in this case the difference between the normal pressure and that evolved on sudden rushes of gas is relatively great.

Upon the quicksilver *d* there is moreover placed a little layer of water *e* which, as is well known, has for its purpose to prevent the retention of little drops of quicksilver on the walls of the tube. In order to prevent this water layer from being lost during the operations, there is provided a second funnel *g* above the funnel or funnels *b*, the point of *g* being turned upwards and then bent down in the manner of a horn. In addition to the opening *h* in the point of this funnel there is provided at its base another opening *i* for the return flow of the water. This funnel *g* acts as follows. Each bubble of carbonic acid carries a certain quantity of water with it. By striking on the glass funnel *g* the bubbles burst, and the water deposits then and underneath the same so that it flows back again into the water layer *e*. If some bubbles should not burst in the funnel *g* they will be turned downwards by its point and burst in the small ring between the base and the point of the funnel. Here also the water deposit flows back through the opening *i*. According to need, two or more of such funnels *g* may be provided.

The modification shown in Figs. 2 and 3 differs from the first one in that a bell *n* is provided instead of the funnel *g*, but for the same purpose. The bell is held by arms on the walls of the tube *a'*, and between its outer border and the wall of the tube *a'* there is only a very narrow passage left for the escaping gas. A plurality of such bells may be arranged one above the other, if desired. They may lie all over the funnel or funnels *b*, or they may be mixed with the latter. The upper end of the tube *a'* is further closed with the exception of one or more small openings *m*, which may be provided in the top or in the sides of the tube *a'*.

I claim:

1. A quicksilver closure for fermentation vessels and the like, comprising a U-shaped tube and a funnel arranged in the ascending limb of said tube above the normal quicksilver level, the point of the funnel being directed downwardly, substantially as and for the purpose set forth.

2. A quicksilver closure for fermentation vessels and the like, comprising a U-shaped tube and a plurality of funnels arranged in the ascending limb of said tube above the normal quicksilver level, the points of the funnels being directed downwardly, substantially as and for the purpose set forth.

3. A quicksilver closure for fermentation vessels and the like, comprising a U-shaped tube and a funnel and a bell arranged in the ascending limb of said tube above the normal



quicksilver level, the point of the funnel being directed downwardly, substantially as and for the purpose set forth.

4. A quicksilver closure for fermentation  
5 vessels and the like, comprising a U-shaped tube and a plurality of funnels and a bell arranged in the ascending limb of said tube above the normal quicksilver level, the points of the funnels being directed downwardly,

substantially as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLY LAZARUS.

Witnesses:

JULIUS ROJIKE,  
HUGO LEBELT.