June 1, 1954 O. E. ANDRUS 2,679,747

VISCOUS LIQUID TYPE SEAM TESTER

Filed March 31, 1950

FIG. 1.

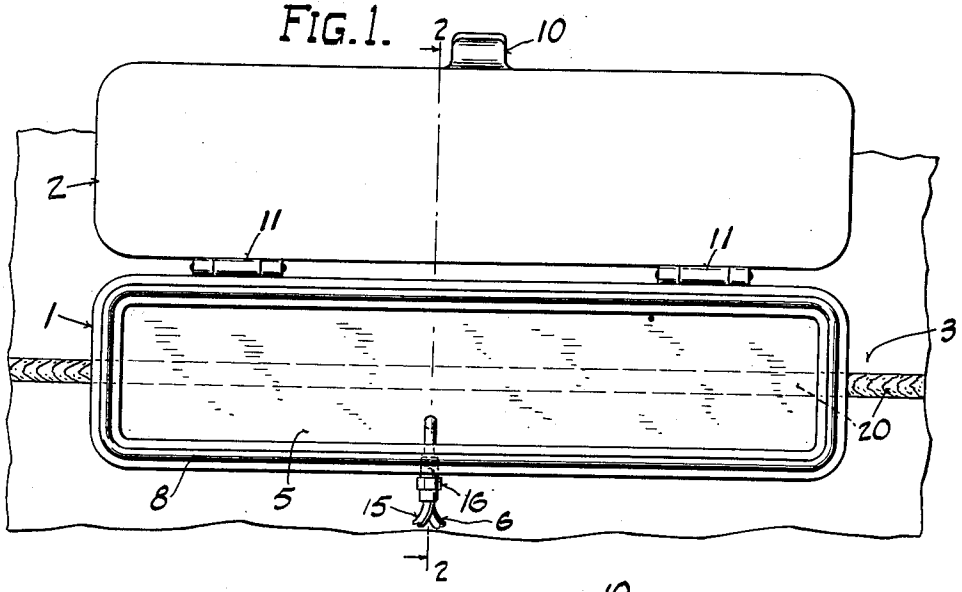


FIG. 2.

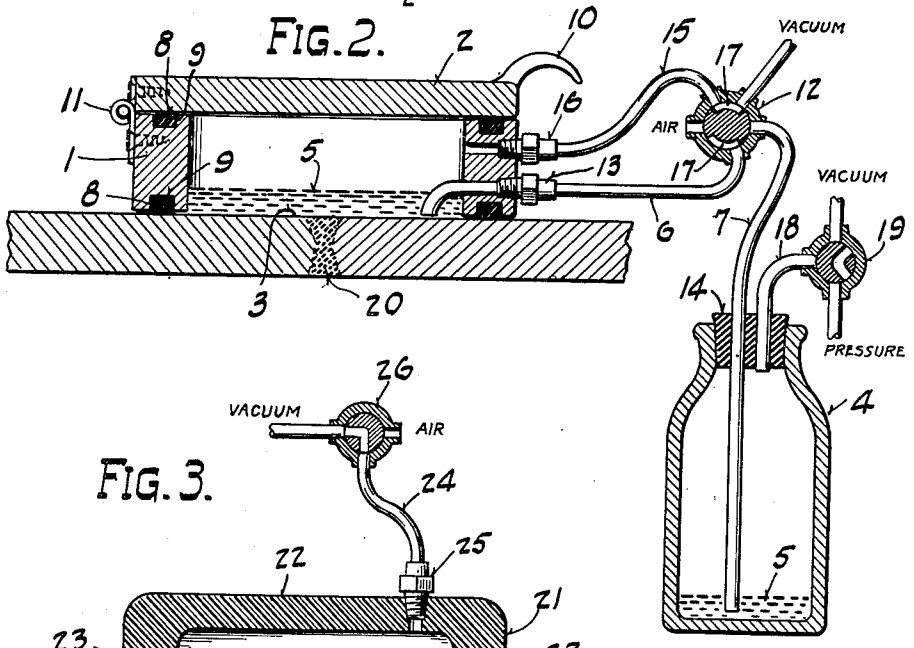


FIG. 3.

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VISCOUS LIQUID TYPE SEAM TESTER

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3 Claims. (Cl. 73—40)

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This invention relates to vacuum type seam testing apparatus.

An object of the invention is to provide testing apparatus whereby a vacuum is produced over a portion of a seam and the leaks in said portion detected by observing, after the release of the vacuum, the presence of air bubbles in a liquid previously applied to the seam and having a sufficiently high viscosity to retain the bubbles for a considerable period of time.

Another object of the invention is to provide seam testing apparatus which eliminates the necessity of observing the seam during the interval when the vacuum is applied.

Another object of the invention is to provide means for easily and rapidly applying a viscous liquid to a portion of the seam to be tested and for removing said liquid after the completion of the testing operation.

Another object of the invention is to provide a seam testing apparatus which is sufficiently strong to withstand a high vacuum over a large area and which has no windows or other easily breakable parts.

Another object of the invention is to provide apparatus which may be used to test the seams of vertical and overhead surfaces.

The apparatus, in general, comprises a hood member adapted with suitable gaskets to be sealed over a portion of the seam to be tested, a suction-pressure flask in communicating relation with the hood and operable to apply a viscous liquid to the seam and to remove the same after the testing operation, and means to evacuate the hood and cause air to enter through apertures in the seam and form bubbles in the liquid. The top of the hood is removable so that the bubbles, which are retained for a considerable period of time due to the viscosity of the liquid, may be observed and the presence of leaks thereby detected. In another embodiment of the invention, the viscous liquid is merely brushed on the seam and the retained bubbles observed by removing the entire hood after the release of the vacuum.

Other objects and advantages will be set forth more fully in the following description of embodiments of the invention illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a top plan view of the seam tester, showing the cover in open position;

Fig. 2 is a cross section taken along line 2—2 of Fig. 1; and

Fig. 3 is a cross-sectional view of an embodiment wherein the top of the hood is not removable and the viscous liquid is merely brushed on the seam to be tested.

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Referring to the drawings and particularly to the embodiment of the invention illustrated in Figs. 1 and 2, a hood member 1 having a removable cover 2 is shown with its open bottom portion applied to a seamed surface 3 of the object to be tested. A suction-pressure flask 4 containing a viscous liquid 5 communicates through a pair of flexible tubes 6 and 7 with the hood 1 and serves to alternately apply the liquid 5 to the seamed surface 3 within the hood 1 and to remove the same therefrom as will be described subsequently.

The hood 1, which may be of generally rectangular shape, is preferably sealed by means of soft rubber O-rings 8 disposed in corresponding grooves 9 in its upper and lower edges. The O-rings are of circular cross section and protrude above their corresponding edges for engagement with the cover 2 and seamed surface 3. When a vacuum is created within the hood 1 the outside air pressure forces the cover 2 downwardly, causing the O-rings 8 to assume generally elliptical cross sections and efficiently seal the hood to air and liquid tightness.

The hood and cover 2 are made of metal or other unbreakable and non-transparent material and are sufficiently strong to withstand the pressure caused by the creation of a relatively high vacuum within the hood 1.

To provide for the ready inspection of the liquid 5 after the release of the vacuum, a handle 10 is attached to one edge of the cover 2 and suitable hinges 11 are secured to the other edge thereof and to the corresponding edge of the hood 1.

Referring to Fig. 2, the liquid tube 6 is connected to a two position double-acting valve 12 and extends therefrom through a fitting 13 in one wall of the hood 1 for termination closely adjacent the seamed surface 3 to be tested for leaks. The tube 7, which is also connected to the valve 12, passes through a two hole stopper 14 in the neck of the flask 4 and is immersed a substantial distance beneath the surface of the liquid 5. Accordingly, the creation of a suction or pressure within the flask 4 may operate to transfer the liquid, via the tubes 6 and 7 and the valve 12, between the flask 4 and the hood 1.

The hood 1 is evacuated during the testing operation by means of a vacuum pump, not shown, which is connected through a valve 12 and a tube 15 to a fitting 16 disposed in a wall of the hood

1 above the level of the liquid 5. In addition to its ports for the vacuum pump and the tubes 6, 7, and 15, the valve 12 is provided with an opening to the air so that the vacuum in the hood 1 may be released for easy opening of the cover 2.

The valve 12 is constructed with a pair of internal passages 17 which are arranged so that when the valve is turned to its "vacuum" position, as shown in Fig. 2, the line to the vacuum pump is connected with the tube 15 but the tubes 6 and 7 are not in communication with each other. When the valve 12 is turned counterclockwise to its "air-liquid" position, the tube 15 is connected with the air opening and the liquid lines 6 and 7 are in communicating relationship.

Because of the described construction of the valve 12, the hood 1 may be evacuated without the necessity of evacuating the flask 4. In addition, the cover 2 may be left down while the liquid 5 is transferred between the flask 4 and the hood 1. This is because the air opening in the valve 12 eliminates the possibility of back pressures as the level of the liquid in the hood 1 is raised or lowered.

In order to provide for the creation of either a vacuum or a pressure within the flask 4, a tube 18 is inserted a slight distance through the stopper 14 and connected via a three position valve 19 to suitable sources of pressure and vacuum, not shown. The turning of the valve 19 to its pressure position causes the liquid 5 to be forced through the tubes 6 and 7 and into the hood 1, whereas the turning of the valve 19 to its vacuum position causes the liquid 5 to be sucked back into the flask 4. The third position of valve 19 is its off position, wherein the tube 18 is blocked and neither a vacuum nor a pressure is created.

When the hood 1 is evacuated after application of the liquid 5 to the seamed surface 3 within the hood, the resulting pressure differential causes air to enter through any leaks in said surface, for example through pin holes in the butt weld 20 shown in the drawings. Accordingly, bubbles are formed in the liquid 5 above each leak and retained, due to the viscosity of the liquid, until they are observed by the operator of the device after the release of the vacuum and the lifting of the cover 2.

It is important that the liquid 5 have sufficient viscosity to enable it to retain the bubbles for a considerable period of time. On the other hand, the liquid must not be so thick that the leaks are in effect sealed and the entrance of air prevented. Various gelatinous liquids may be used, as well as oil, syrup, etc. Soap solutions may also be used if the percentage of soap is sufficiently high.

The liquid used is preferably transparent, so that the small bubbles frozen in the body of the liquid may be easily observed. Where the liquid is not transparent the presence of leaks is determined by noting the presence of bubbles on the surface thereof.

It has been found that a transparent, colorless mineral oil of a viscosity equivalent to S. A. E. 70 subjected to a vacuum of 28 inches of mercury produces the desired results. For average work, the vacuum is maintained for a period of one to five minutes. However, where maximum freedom of porosity is essential a more viscous liquid should be used subjected to higher vacuums for greater periods of time.

The operation of the seam testing apparatus is as follows: assume that the hood 1 has been positioned on the seamed surface 3 and that the cover 2 is down and in engagement with one of the O-rings 8. The operator then turns the valve 19 to its pressure position and the valve 12 to its air-liquid position, causing the viscous liquid 5 to flow through the tubes 6 and 7 and fill the hood 1 to a depth of approximately an eighth of an inch.

The operator next turns valve 19 to "off" and the valve 12 to "vacuum," causing the evacuation of the hood 1 and the formation of bubbles in the liquid 5 as previously described.

Valve 12 is then turned to its air-liquid position and air is admitted to the hood 1 to release the vacuum. The cover 2 of the hood is then lifted and the location of the retained bubbles noted so that the corresponding leaks in the weld 20 may be repaired at a later time.

The cycle is completed by turning the valve 19 to vacuum and sucking the liquid 5 back into the flask 4, after which the operator moves the apparatus to another portion of the seam and repeats the operation.

Referring to the embodiment of the invention illustrated in Fig. 3, a generally rectangular hood 21 is formed with a cover portion 22 which is integral with the walls of the hood 21 and is therefore not removable. The hood 21 is sealed to the seamed surface 3 by means of an O-ring 23 which corresponds to the lower O-ring 8 of the first embodiment and functions in the same way.

To provide for the evacuation of the hood, a hose 24 is connected between a fitting 25 in the cover portion 22 and a two-position valve 26 in the line of a vacuum pump, not shown. When the valve 26 is in one position the hose 24 communicates with the vacuum pump and a vacuum is created within the hood 21, whereas the turning of the valve 26 to its other position admits air to the hood 21 and releases the vacuum therein.

In operating the apparatus, a thin layer of viscous liquid is applied by brushing or similar means to a portion of the seamed surface 3 to be tested. The hood 21 is then placed in position and evacuated, causing air to enter through leaks in the seam and form bubbles on the surface of the liquid. These bubbles remain, due to the properties of the liquid used, until the operator releases the vacuum, lifts the hood 21, and notes the location of the leaks.

The liquid used may in most cases be the same as that selected for the first embodiment, with a high surface tension being a desirable property. A thick soap solution, which retains its bubbles for a substantial interval of time, has been found to be one of the best liquids to use.

The use of a thin layer of viscous liquid is particularly advantageous where it is desired to test vertical or overhead seams. In these applications it is desirable to use a hood made of a light material such as plastic or rubber, so that the operator may manipulate the apparatus without excessive fatigue.

The apparatus described in connection with both embodiments of the invention provides a simple means for testing a seam without the necessity of observing the seam during the period when the vacuum is applied. Consequently, there is no need for breakable parts such as windows, and the apparatus may be made unbreakable, particularly when the flask 4 is made of metal instead of glass.

The hoods 1 and 21 may be made of either metal, for high rigidity and pressure resistance, or flexible material such as rubber or plastic, for

ability to test various shapes and types of curved seams.

Although only one shape of hood has been shown in the drawings, many other shapes may be used in special applications such as in the testing of corners, edge seams, etc.

Various embodiments of the invention may be employed within the scope of the accompanying claims.

I claim:

1. In a vacuum operated apparatus for testing the welded surface of metallic articles to ascertain whether there are any leaks therein, a cover member adapted to be sealed in spaced relation with the welded surface to be tested and to create with said welded surface a fluid tight chamber, a substance for application to said surface within said chamber in a layer of pre-determined thickness, said substance having a high surface tension and a viscosity low enough to permit entrance of air into the substance but high enough to trap air in the substance in the form of bubbles with said bubbles remaining frozen for observation a considerable length of time after forming and after the evacuation of the chamber is completed and the vacuum is broken, and means to evacuate said chamber to draw air through leaks in said surface into the substance and form said bubbles therein.

2. In vacuum operated apparatus for testing the welded surface of metallic articles to ascertain whether there are any leaks therein, a cover member adapted to be sealed in spaced relation with the welded surface to be tested and to create with said welded surface a fluid tight chamber, a transparent colorless mineral oil for application to said surface within said chamber in a layer of predetermined thickness, said oil having a viscosity equivalent to S. A. E. 70, said viscosity being low enough to permit entrance of air into the oil but high enough to trap air in the oil in the form of bubbles with said bubbles remaining frozen for observation a considerable length of time after forming, and means to evacuate said chamber under a vacuum of approximately 28 inches of mercury to draw air through leaks in said surface into the oil and form said bubbles therein.

3. Vacuum operated apparatus for testing the welded surface of metallic articles to ascertain whether there are any leaks therein, which comprises a hood member having depending sides extending downwardly from the top of the hood toward the welded surface to space the top of the hood from the welded surface and provide a chamber between the hood and welded surface, gasket means disposed between the hood and surface to seal off the chamber, a pressure vessel, a liquid stored in said pressure vessel for application to said surface within said chamber in a layer of predetermined thickness, said liquid having a high surface tension and a viscosity low enough to permit entrance of air into the liquid but high enough to trap air in the liquid in the form of bubbles with said bubbles remaining frozen for observation a considerable length of time after forming and after the evacuation of the chamber is completed, a double acting valve having a vacuum and an air liquid position, a tube connecting the pressure vessel and valve, a suction tube connecting the hood and valve, and a pressure tube connecting the hood and valve, a second valve connected to said pressure vessel, means to operate said second valve to apply pressure to said pressure vessel when the double acting valve is in air liquid position to force liquid from the vessel into the hood chamber and into contact with the welded surface and to apply vacuum to said pressure vessel to withdraw liquid from the chamber back into the vessel, means to actuate said double acting valve to vacuum or air liquid position, and a vacuum pump connected to the double acting valve to evacuate the hood chamber when the double acting valve is in vacuum position and draw air through leaks in said surface into said liquid and form said bubbles therein.

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