March 2, 1965 D. S. ROLLE 3,171,874

METHOD OF SEALING LADING VEHICLES

Filed Oct. 20, 1961 2 Sheets-Sheet 1

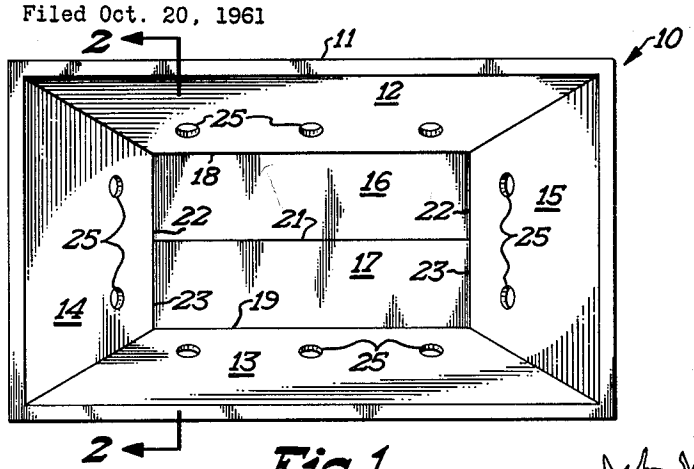


Fig 1

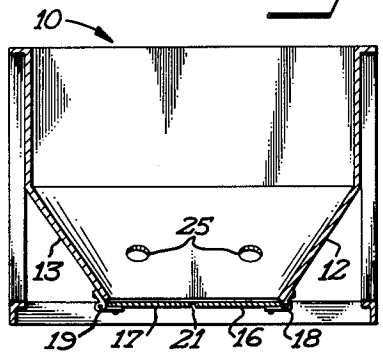


Fig 2

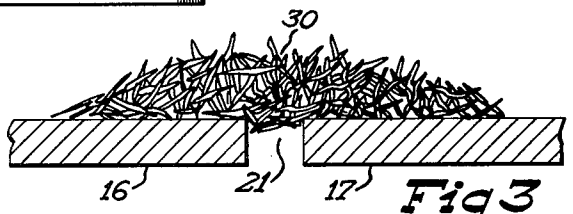


Fig 3

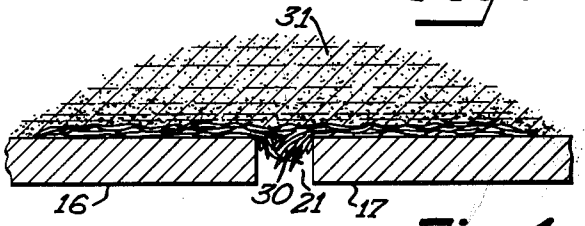


Fig 4

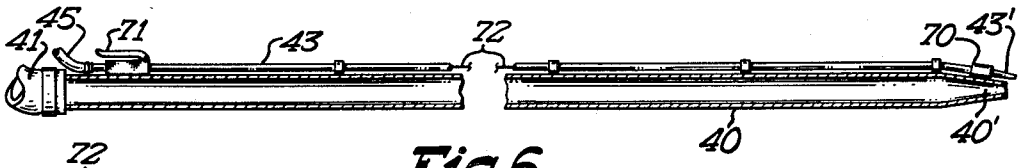


Fig 6

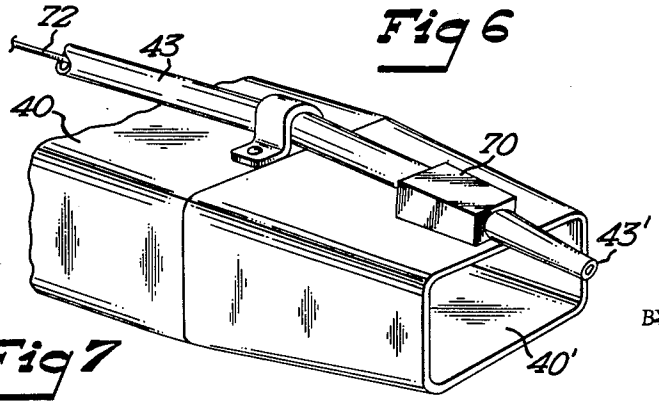


Fig 7

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March 2, 1965 D. S. ROLLE 3,171,874

METHOD OF SEALING LADING VEHICLES

Filed Oct. 20, 1961 2 Sheets-Sheet 2

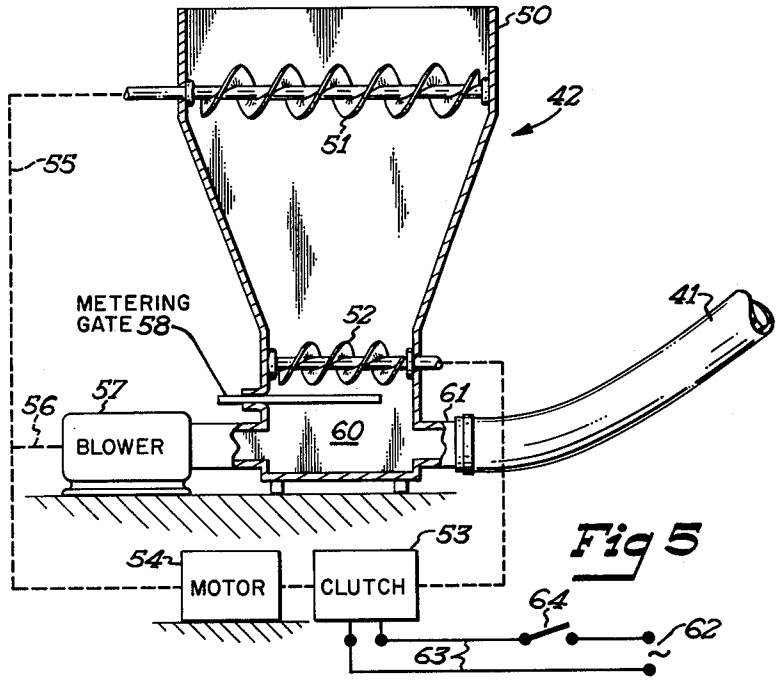


Fig 5

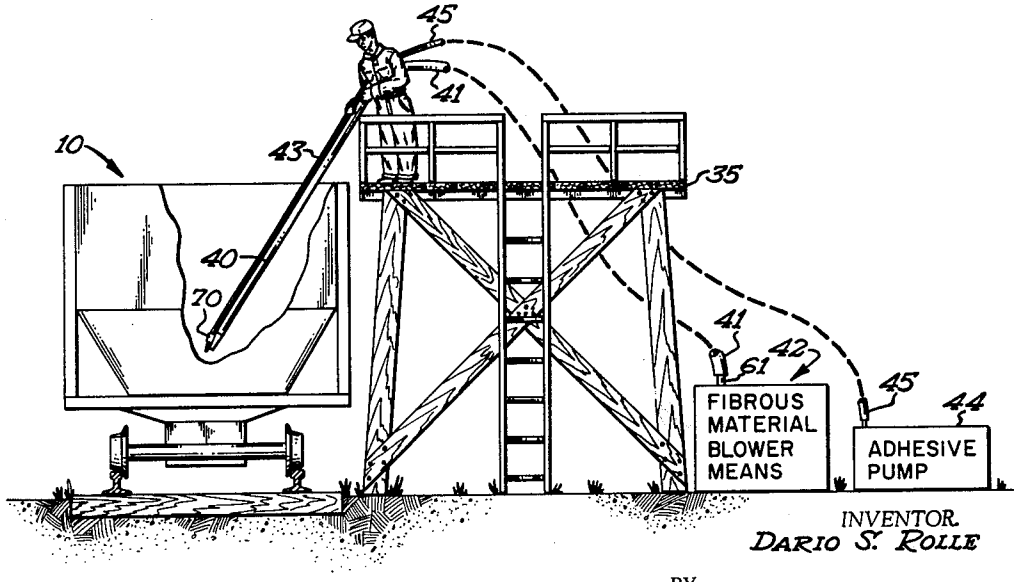


Fig 8

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United States Patent Office 3,171,874 Patented Mar. 2, 1965

3,171,874

METHOD OF SEALING LADING VEHICLES

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Filed Oct. 20, 1961, Ser. No. 146,553
1 Claim. (Cl. 264—267)

This invention relates to sealing openings in a lading body of a vehicle such as a rail car for carrying iron ore. The invention is especially useful for sealing openings in a rail car used for transporting finely divided iron ore from a loading point to a point of discharge where such ore is discharged or dumped upon the release of doors in the bottom of the car. While the present specification will deal with the specific example of iron ore cars, it will be understood that the invention may be applied to the sealing of other containers as well.

When rich iron ore deposits are found, the ore may be loaded directly in ore cars and carried to a point of discharge such as an ore dock. However, when the ore is not rich, then it must be processed and concentrated near the mines before it is shipped. As rich ore deposits expire, there is more and more emphasis on processing and concentrating the low grade ore which remains.

Various processes are used for concentrating the ore. Usually they involve the ore being crushed and treated so that it is very finely divided (80 mesh and finer). Also large quantities of water are generally used in the final stages of processing the finely divided ore. Accordingly, when the treated or processed ore is transferred to rail car loading hoppers, it is not unusual for the hoppers to have a large amount of water intermixed with the ore. In some cases the ore in the hoppers has a consistency which may be likened to a freshly mixed batch of cement having a high percentage of water therein.

The hoppers or loading pockets as they are sometimes identified have discharge openings in the bottom thereof, under which the ore cars pass on tracks for filling. One arrangement involves three "pockets" or discharge openings arranged longitudinally (with respect to the car and railroad track thereunder) and each pocket has a different grade of ore therein. By proper control of the discharge of ore from each pocket a particular blend of ore can be obtained.

Iron ore cars in wide spread use are designed to carry approximately 70 tons of ore. Each car has two main doors in the bottom thereof, which when opened, permit the car to be emptied, the ore moving down under the influence of gravity. The doors or gates as they are sometimes identified, when closed have a common joint or seam defined therebetween and each gate also has two joints or seams (one at each end), defined therebetween and the fixed end portions of the car. The doors seldom fit tightly with respect to one another or with respect to the fixed part of the car. Accordingly, the joints or seams are more accurately described as gaps or cracks or openings. These gaps or openings are the rule rather than the exception and are caused in part by the cars being "sprung" out of their normal shape by excessive shocks, impacts, or loads. These gaps or openings are occasionally as large as one to two inches wide and one-half inch gaps are very common. In addition, it is customary to provide in the fixed sides and ends of the cars a plurality of steam jet or steam lance openings which function to permit the insertion of a steam lance to thaw out frozen ore during cold weather. This is necessary in order to permit the discharge of such ore through the bottom of the car. The steam openings generally are about two inches in diameter and theoretically are closed off when desired by round cover plates. In practice the cover plates become loose and/or bent and do not tightly close off the steam openings.

For many years the mining companies have known that

the fine ore would pass through the cracks, gaps, and openings described above. This is especially true when there is a considerable quantity of water in the hoppers which is the usual situation. Much ore seeps through the cracks and openings while the car is being filled and shortly thereafter. This results in the trackage area at the filling hopper to get covered with a "mud" of very wet fine ore. If not removed, this "mud" will accumulate to the paint where the trackage becomes impassible for the ore cars and locomotives which position the same. The ore so immediately lost can be recovered and shipped but involves much additional expense in terms of labor and/or machinery.

Besides such ore which is lost adjacent the loading hoppers, much additional ore seeps through the above described openings during transit of the cars from the ore concentration plant to the destination of the ore (pelletizing plant, ore dock for lake shipping, steel mill, etc.). The vibration of the ore car as it travels over the tracks or rails contributes to this loss. Further, this ore distributed along the railroad right-of-way can not be recovered.

Because of the great expense associated with the above described loss of ore, the mining companies have tried various means and methods to eliminate or allieviate the loss.

One prior arrangement has been to use a blanket of dried grass or "hay" in the bottom of the car to provide a seal for the fine ore but to permit the escape or drainage of the water. The hay is placed in the bottom of the car by a laborer throwing the hay into the car with a pitchfork. This has not been satisfactory for various reasons. First, the material and labor cost is quite high. Also, some of the openings are either vertical or are slanted away from the horizontal and it is difficult to keep the hay abutted against the opening. To seal steam openings, the hay has to be manually stuffed into the holes. The ore being dumped into the car from a loading pocket has tremendous force and tends to sweep the hay away leaving the cracks or openings described above uncovered. Also, the fine ore still works its way through the hay. In general it is expensive to use hay and the end results still do not prevent the loss of ore.

Complete preformed liners such as plastic have also been tried for sealing an ore car. These not only are expensive in direct material cost but also are unsatisfactory because they do not permit the drainage of the water in the ore from the car. It will be understood that it is very uneconomical to ship a high percentage of water in the ore.

Preformed mats of porous material have also been tried. They are positioned in the bottom of the car so as to overlay the cracks between the doors and the fixed portion of the car before the ore is dumped into the car from the loading pockets above. Such a mat is initially flat and may have fibres such as hogs hair as the main material. These mats have not been satisfactory. They have a high initial cost in terms of material alone. Also they often are swept out of position by the ore as it is first dumped into the car. This is especially apt to happen when "blending" is being done and the ore is initially dumped from a pocket above a slanted end surface of the car. Sometimes the mat is "shot" right out of the ore car by this initial quantity of ore. However, even if the mat is not swept out of position, it still does not completely prevent fine ore from passing through the door openings. Accordingly the "mud" below the hopper and the loss along the railroad right-of-way during transit still occurs. Also the mats do not cover the steam openings so they have to be sealed in addition. One way to do this is to use metal or wooden plugs or wedges to seal the opening. This involves more expense and these mechanical arrangements often vibrate loose during transit

of the car and hence still do not prevent the loss of ore.

The present invention solves the many aspects of the above described problem simply, effectively, and, of great importance, economically.

The present method of sealing ore cars provides a water or liquid pervious but finely divided ore impervious seal for all the openings and cracks in the car by bridging the opening with a large quantity of fibrous material, the fibrous material being intermixed with a suitable liquid adhesive (to be described in more detail below), and the fibrous material as mixed with the adhesive adhering to the portions of the car adjacent the opening or crack. In this manner, the opening or crack is bridged over by a seal is effective to retain even the finest of ores (200 mesh). At the same time, water or other liquid in the ore may filter through the seal and be discharged from the car.

In the preferred embodiment of the invention, the adhesive is a liquid adhesive which is shot or sprayed from a nozzle under pressure. An adhesive which works very well is one manufactured and sold by the Swift Packing Company under their type number 7103. This adhesive has a low viscosity, and a resin reinforced synthetic rubber base with hexane as a solvent diluent. This adhesive has the property of adhering to almost anything and readily adheres to a metallic surface such as the side, end, or door of an ore car even if the surface thereof is dirty, rusty, wet, or otherwise contaminated.

Various fibrous materials may be used with the present invention. I have found one that is especially well suited from both results and an economic standpoint. It is the type of wood shavings commercially available from planing mills and the like. Another fibrous material that works very well is a wood cellulose product commercially known as "excelsior." It is characterized by having long strands of tough fibre. Other fibrous materials may be used as well.

The adhesive may be first applied to the surfaces to be sealed and then the fibrous material applied, or the fibrous material and the adhesive may be premixed and applied so as to bridge over the opening to be sealed. In a preferred embodiment of the invention, I provide an apparatus comprising a pair of nozzles, one a large bore device for applying fibrous material and the other a relatively small bore device for applying the liquid adhesive. The pair of nozzles are arranged so that they may be manually manipulated by an operator in the sense that he may move the nozzles about to place the discharge openings thereof adjacent any desired location inside of the ore car. For this arrangement, the operator would be stationed on a raised platform along the side of which the cars progress as they move toward the loading hoppers. The nozzles may be individually controlled by the operator from the standpoint of regulating the flow of materials from the discharge openings thereof. In this manner, the operator may apply liquid adhesive only, fibrous material only, or both materials simultaneously.

In the preferred embodiment, the individual fibres of the fibrous material have an appreciable unit length. This greatly assists in bridging across the gap or opening to be sealed. These fibres in combination with the adhesive which bonds them with respect to the car provide great strength against pressure applied perpendicular to the opening. It is not uncommon to find intermixed with commercial wood shavings a substantial quantity of sawdust or relatively small wood particles. This is no problem and in fact in some instances may be considered an advantage because the individual sawdust particles also coact with the adhesive so as to adhere to the object against which they are impelled. Thus the longer fibers assist in bridging the main gap and the smaller particles contribute to the overall sealing process by filling up the relatively small openings defined between overlapped or interweaved longer fibres. Actually, I have found for some types of sealing problems that using only a relatively finely granulated material such as a commercial sawdust in combination with the liquid adhesive works very well and provides an excellent fine ore impervious-liquid pervious seal. This can be done either where the crack or opening is not too wide or large or where first a webbing of adhesive is sprayed across the opening to be sealed, the web so produced providing a base upon which the sawdust particles may build up so as to ultimately bridge over the opening.

It will be understood therefore that there are various facets to my invention, one of them being the variation in sequence of applying materials, and another being the variation in choice of filler material. All arrangements are characterized however by the resultant seal of the crack or opening being effective to retain the "fines" (fine ore) within the car and yet is pervious to water so as to permit the water to drain from the car. The seal tenaciously adheres to the opening or crack and is not dislodged or swept away from the same when ore is dumped into the car from a loading pocket. Each steam opening can be easily sealed. The seal does not interfere with the unloading of the cars; when the doors are tripped, the huge mass of ore will break the seal. Also, if it is necessary to thaw the ore (such as during cold weather) the steam lances can be easily pushed through the steam opening and the seal and into the body of ore. Also the seal does not vibrate loose during transit of the car.

It is an object of this invention therefore to provide an improved sealing method for a vehicle having a lading body with openings through which may pass finely divided material, the sealing method sealing the openings to the passage of fine material but yet allowing the passage of water or other liquid through the seal.

Other objects of the invention will become apparent from a reading of the present specification including the appended claim in connection with the drawings in which:

FIGURE 1 depicts a top view of a lading body such as is typical of an iron ore car in widespread use;

FIGURE 2 is a cross-section of the body shown in FIGURE 1;

FIGURE 3 is a simplified showing of a pair of elements defining an opening therebetween, the opening having been sealed pursuant to the teaching of the invention;

FIGURE 4 is a view of the FIGURE 3 arrangement with the seal compressed by a body of ore;

FIGURE 5 depicts a fibrous material blowing machine;

FIGURE 6 depicts a double nozzle arrangement of great utility in the present invention for intermixing fibrous material and liquid adhesive and for directing the discharge of the materials toward the item to be sealed;

FIGURE 7 shows an enlarged view of the discharge openings of the nozzles of FIGURE 6; and

FIGURE 8 shows one typical arrangement for practicing the method aspects of the present invention.

Referring to FIGURE 1, the reference numeral **10** generally designates an ore car or vehicle having a lading body **11**. The body has two longitudinal or side portions **12** and **13** and two end portions **14** and **15**. As is clearly shown in FIGURE 2, the sides **12** and **13** have upper vertical portions and lower slanted portions which are sloped toward one another. A pair of doors **16** and **17** hinged as at **18** and **19** respectively are shown in a closed position (and are adapted to be held there by means not shown) effective to retain lading within the car except for leakage to be described below. When the doors are tripped (by means not shown), then they swing downwardly to permit the discharge of lading. For simplicity, the car **10** has been shown very schematically.

As shown in FIGURES 1 and 2, the doors **16** and **17** define therebetween a gap, crack, or opening **21**. Further the doors **16** and **17** define between the fixed portions **14** and **15** of the car a plurality of cracks or openings **22** and **23** respectively.

A plurality of circular openings **25** are provided in the members **12–15**. These are often provided where freez-

ing of the ore is apt to occur, and, as indicated above, permit the insertion of steam lances from the outside of the car for permitting the thawing of the ore. The openings **25** usually are provided with mechancial closures (not shown) on the outer surface of the members **12–15**. However, these closures are often unsatisfactory for retaining finely divided ore in the car due to a loose fit and the like.

FIGURES 3 and 4 show an enlarged view of the doors **16** and **17**. The opening **21** may vary in width from a small crack to a large opening of one to two inches (the size of the gap tends in part to be a function of how badly the car is sprung out of its original shape).

In FIGURE 3 a seal identified by reference numeral **30** is shown sealing off the opening **21**. The seal is only schematically shown but it generally consists of intermixed fibrous material and liquid adhesive. As indicated above, one combination that works very well is that of commercial wood shavings and liquid adhesive sold by the Swift Packing Company, type No. 7103. It will be understood, however, that other adhesives and other fibrous materials may be used within the scope of the invention.

The adhesive may be initially applied to the inside surfaces of the doors **16** and **17** along the entire extent of the opening **21**. Then the wood shavings may be applied against the adhesive and will adhere thereto and "bridge" over the gap or opening **21**. An alternative method which has the advantage of being quicker is to blend or intermix the shavings and the liquid adhesive prior to their application to the surface to be sealed. This preferably is done by using a double nozzle arrangement as described above where liquid adhesive from one nozzle and fibres from another nozzle are simultaneously discharged and caused to intermix adjacent the discharge openings of the nozzle. Then, due to their velocity from being discharged from the nozzles, the intermixed materials continue to move and are impelled against and adhere to the doors **16** and **17** adjacent the opening **21**. Thus the opening **21** is "bridged" over by a seal.

The seal **30** tenaciously clings to the doors **16** and **17** and seals the opening. When a quantity of ore **31** (FIGURE 4) is placed into the car, there is some tendency to compress the seal **30**. However I have found that the ore being dumped into a car from a loading pocket will not "shoot out" or tear away the seal **30** as was often the case with the prior art arrangements of using blankets of hay or other material placed in the bottom of the cars. The compression of the seal **30** has a beneficial result of increasing the density of the seal. By this I mean that the compressed seal is effective to retain even the finest of ores (200 mesh). At the same time the large amount of water in the ore may leach or filter through the seal and leave the car. Thus the car is effectively sealed with a water or liquid pervious-finely divided material impervious arrangement. I have found where my seal has been used to seal large cracks (one to two inches) in an iron ore car filled with very fine ore, that substantially no ore was lost from the car. Further, at the same time the water in the ore filtered through the seal and "ran" from the car clean and clear having no traces of ore therein.

When it is desired to unload the cars, the doors **16** and **17** are tripped and the great mass of ore will then be effective in coacting with the doors to break the seal and discharge down from the car.

It will be understood that all openings through which ore can leak should be sealed. Thus with my invention the intermixed fibrous material and liquid adhesive may be used, not only for sealing cracks **21**, **22**, and **23**, but also for sealing hinge lines **18** and **19** and steam jet openings **25**.

Various mechanisms may be used for actually practicing my method of sealing containers. One arrangement which works very well is somewhat schematically shown in FIGURE 8. Here, a car **10** is on a track adjacent to a suitable platform **35** preferably about the same height as that of car **10**. An operator manipulates a special double nozzle (see FIGURES 6–8) and directs the flow of fibrous material and liquid adhesive against the cracks and openings to be sealed. A first nozzle **40** is connected by a large diameter flexible hose **41** to a fibrous material blower means **42** (see FIGURE 5). A second and smaller nozzle **43** for spraying liquid adhesive is connected to an adhesive pump **44** by a suitable hose **45**.

Referring to FIGURE 5, the blower means **42** is shown in more detail. It comprises a hopper **50** for receiving bulk fibrous material such as bailed wood shavings. These shavings are agitated or "fluffed up" by suitable means such as a continuously driven auger **51**. A feed auger **52** is driven through an electrically operated clutch **53** by a motor **54**. The motor **54** also through suitable connections **55** and **56** drives the auger **51** and a blower **57**. A metering gate **58** is adjustably positioned to control the rate of flow of fibrous material from the top portion of hopper **50** into a discharge portion or zone **60**. Fibrous material which enters the zone **60** is blown by blower **57** through a discharge opening **61** to which is connected or coupled the large diameter flexible hose **41**. The clutch **53** may be of any suitable type such as one which is electrically engaged to transmit torque. This may be effected by controlling the energization of clutch **53** from a source of power **62** through leads **63** and a switch **64**. When clutch **53** is engaged then feed auger **52** is rotated to cause fibrous material to be transferred down into the discharge zone **60**.

One machine that may be used as the fibrous material blower means and a machine that I have found to be very satisfactory is a Vanco Insulation Blower, manufactured by the Vanco Machine Company of Van Wert, Ohio. This machine has the type number or designator Vanco Automatic, VH 4590 IH. I have found that using this machine with approximately three pounds per square inch pressure at the discharge nozzle on the wood shavings or other fibrous mterial works very well.

One suitable pumping means **44** which may be used with the present invention is the Graco-Power Flo President Type of air powered pump. It is manufactured by the Gray Company of Minneapolis, Minnesota. It will be understood that other blower means and pumping means may be used in practicing the present invention.

The nozzles **40** and **43** are shown in more detail in FIGURE 6. Preferably they are long enough (see FIGURE 8) to permit the operator to reach all of the cracks and openings in the car that require sealing. An overall length of approximately twelve feet has been found satisfactory for sealing a 70 ton car, the sealing being done from a platform approximately the height of the car. The nozzles are preferably fastened together by suitable means so that they may be simultaneously manipulated as described above. The nozzle **40** terminates in a tapered portion **40'** which is shown clearly in FIGURE 7. Nozzle **43** terminates as at **43'**. One arrangement which has worked well is to have the opening **40'** approximately 3½ inches x 1½ inches and the nozzle termination **43'** projecting ahead of termination **40'** by slightly more than one inch. This is with an aperture of 0.017 inch for nozzle termination **43'** with the preferred Swift adhesive identified above being under a pressure of 94 pounds per square inch.

The terminations **40'** and **43'** are arranged relative to one another so that liquid adhesive spewing out of **43'** co-mingles with or mixes with fibrous material discharging from opening **40'** about eight inches to one foot from opening **40'**.

The termination **43'** of nozzle **43** has a valve head **70** which is selectively opened by a handle or lever **71** (see FIGURE 6) connected thereto by a fine rod or wire **72** connected therebetween.

The switch **64** for controlling the clutch **53** may conveniently be located on the nozzle assembly depicted in FIGURE 6. Thus the operator can selectively control the application of fibrous material and of liquid adhesive. If only one material is desired, then the appropriate control is actuated; if both are desired such as for simultaneous blending or intermixing, then that also can easily be accomplished by simultaneously opening orifice **43'** with lever **71** and closing switch **64** to engage clutch **53** so as to cause fibrous material to be discharged from nozzle **40'**.

The operator preferably maintains the discharge openings **40'** and **43'** about one foot away from the crack, gap, or opening to be sealed for the above combination of materials, orifice openings, and pressures although this is not critical. While this may be considered an optimum arrangement, a separation of the discharge openings and the crack to be sealed which is greater or less than one foot is permissible. For example, with the above parameters, a spacing of three feet was found to be satisfactory.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

The method of sealing an opening in a lading vehicle such as an ore car prior to the filling of such car with lading at least part of which would otherwise undesirably pass through said opening, said method comprising the application of a stream of fibrous elements intermixed with liquid adhesive means around and across said opening so as to attain a bridging across said opening on the inside of said vehicle with a compressible mat consisting of a substantial number of said fibrous elements randomly arranged and intermixed with said liquid adhesive means so that adjacent elements are bonded to one another and so that elements touching said vehicle adjacent said opening are bonded thereto, said elements and said adhesive means having strength characteristics selected so that subsequent filling of said vehicle with lading may be accomplished without dislodging such elements and adhesive means sealing said opening, and said elements and adhesive means in the form of said compressible mat functioning as a water pervious seal and as a finely-divided solid material impervious seal when compressed as when lading is in said vehicle so as to permit water in such lading to pass through said opening and so as to prevent finely divided solid lading from passing through said opening.

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