July 25, 1944. C. A. PHIPPS 2,354,609

DIFFUSION APPARATUS

Filed Nov. 15, 1940

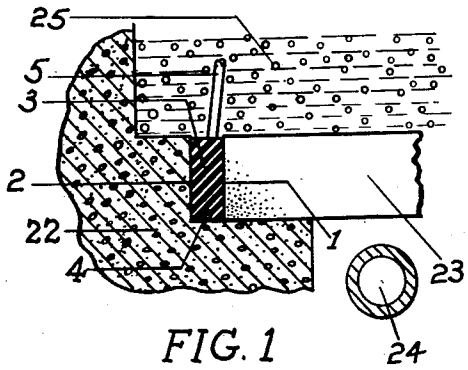

FIG. 1

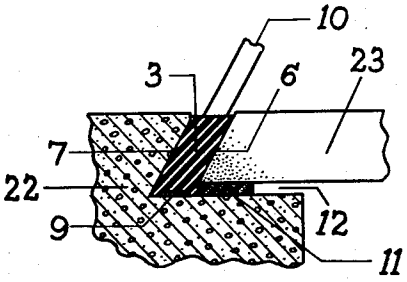

FIG. 2

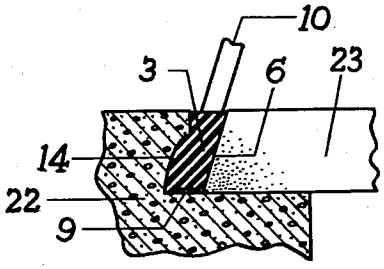

FIG. 3

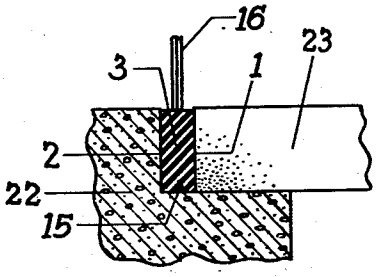

FIG. 4

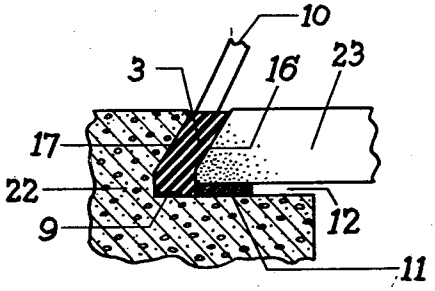

FIG. 5

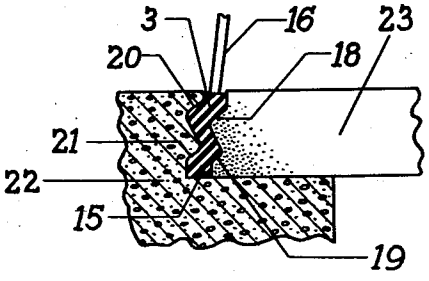

FIG. 6

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DIFFUSION APPARATUS

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Application November 15, 1940, Serial No. 365,849

9 Claims. (Cl. 261—122)

This invention relates to an improved method for fastening porous plates, such as are used for diffusing gases through liquids, for filtration and similar uses, into openings in a supporting structure. It more specifically has relation to the use of latex rubber compounds for joining such plates to the supporting structure in a manner to facilitate their removal for cleaning without excess labor costs, and with greatly reduced danger of breakage.

One of the primary objects of this invention is to provide a means for economically fastening porous plates in holders, in such a manner as to permit them to be removed for cleaning at a similarly reduced cost, without sacrificing the serviceability of the joint with respect to prevention of leakage and holding of the plates firmly and satisfactorily during the period of operation.

Another object of this invention is to provide a means for removing a joint compound cleanly from the space between porous plates and the surrounding structure so as to permit the plates to be easily removed whenever this becomes necessary.

Other objects of this invention will be apparent from the following description and the drawing presented herewith. Although the present invention is described principally with relation to its use in cononection with the diffusion of air through liquids, it is equally useful in connection with other uses of porous mediums, such as for filtration purposes or manufacturing processes.

Diffuser plates are ordinarily made of granular material, the particles of which are fastened together by a binding agent, or fused together, so as to produce a porous plate about one inch thick and one foot square. These plates are ordinarily mounted horizontally in rows on the bottom of a tank, in such a manner that compressed air or other gas can be blown upward through the plates, to rise in a large number of small bubbles through a liquid in the tank.

One of the problems introduced in the operation of equipment of this type is due to the clogging of the pores of the diffuser plates with foreign matter, either from the air or from the liquid, thereby greatly reducing the efficiency of the plates. Various methods for partially cleaning clogged diffuser plates while in position are known. However, it usually becomes necessary to remove the plates at intervals for a cleaning which will restore them to approximately their original efficiency.

It is also essential in the proper operation of this type of equipment, that the diffuser plates be held firmly in place for any desired length of time between such removals for cleaning, without the development of cracks or other openings which would permit air leaks. Any appreciable amount of leakage would reduce the pressure behind the plates to the point that practically no air would be blown through the porous plates, and the process of air diffusion would be halted to that extent.

Various materials such as ordinary mixtures of Portland cement have been used in the past to fasten diffuser plates into openings in concrete holders. These materials effectively prevent leakage when properly installed, but, by their nature, they make it impossible to remove the plates for a thorough cleaning in an economical and rapid manner. In the laborious process of chipping the hardened cement from such joints, and in cleaning the edges of the plates to condition them for reinstalling, a relatively large percentage of the plates are usually damaged or broken. Although a great deal of experimental work has been done during the past twenty-five years in the effort to find a joining material to take the place of Portland cement mixtures or similar materials, which would also permit the plates to be easily removed, none of the materials or methods tried were found to be both satisfactory and economical until the present invention.

Previous efforts to overcome this difficulty have resulted in the development of special metal holders with various arrangements of gaskets and clamps. Other developments include apparatus for swinging an entire assembly of holders and specially shaped diffuser tubes out of the liquid for cleaning. The various mechanical devices are, in each case, considerably more expensive to install than are fixed concrete holders, and the increased cost of these devices has greatly restricted their use. Where pre-molded rubber gaskets are used, their tendency to develop leaks in service limits their practical application.

In view of the need for a practical method for fastening diffuser plates and similar porous mediums so that leaks can be eliminated; the cost of installation greatly reduced as compared with all mechanical devices; and the plates at the same time be quickly and economically removable, I have conducted tests over a long period of time. This work was done in the laboratory and also in practical installations where the methods used would be subjected to the actual conditions of installation and service. As a result, I

have invented a method for installing porous plates which overcomes the disadvantages of previous methods, and which greatly reduces the combined costs of installing and removing such plates as compared with any previously known method.

This invention comprehends the use of latex rubber compounds of a class which will provide a leak-proof joint between the porous plates and the surrounding structure, with the proper amount of adhesion to each, so that the joint will give satisfactory performance during any continuous period of usefulness of the plates, and so that the latex rubber can be readily removed from the joint when desired, to permit removal of the plate.

In my early experiments with latex rubber compounds used for this purpose, joints were made of concentrated latex having a solids content of 70% to 75%, mixed with an anhydrous cement, with small amounts of compounding ingredients to stabilize the mix, and to promote curing of the rubber at ordinary temperatures.

This composition was prepared so as to be poured in the liquid state and to solidify shortly thereafter. Due to the fact that the prevention of leaks over the period of continuous service was a primary consideration, a compound having strong adhesive properties and good resistance to shear was used. These properties are best obtained in a latex compound having a relatively high percentage of aluminous cement together with a highly concentrated latex. A combination of this general type results in a stiff rubber upon solidification, and is capable of bonding securely with surfaces such as concrete. It was found that the edges of porous plates adhere very strongly to rubber compositions of this type.

A typical formula for this use is given as an example, as follows:

Rubber, as contained in latex having 70% to 75% solids, known commercially as "Revertex," 100 parts; water, in addition to that in the latex, 3 to 10 parts; into this is stirred a powder consisting of sulphur, 3 to 4 parts; zinc oxide 1 to 2 parts; tetramethylthiuramdisulfide 1 to 1½ parts; aluminous cement 135–140 parts.

In order to test the use of various proportions of such ingredients, together with means for making joints thereof removable, I installed more than two thousand diffuser plates in a sewage disposal plant, and caused them to be subjected to conditions of practical operation.

Since strong adhesion and resistance to shear in the solidified latex joint material would make the porous plates difficult to remove, and to that extent would detract from the fundamental purpose for using latex in the joints, I caused to be embedded in the joints of certain key plates an aluminum wire of sufficient strength to rupture the joints. Upon applying a strong upward pull to an end of this wire, the solidified joint could at any time be ruptured, and the plate lifted from the concrete holder. Access could thereby be gained to the under sides of the remaining plates, which could then be removed by exerting a strong upward thrust on the under side of each plate, such as by a system of levers or by a screw jack, acting through a metal plate to distribute the thrust evenly throughout the under side of the porous plate. Breakage of the porous material was thereby prevented.

This method for removably fastening porous plates was found to be the best practical means known until further improvements were made by me, and will be further described in detail in connection with the drawing, as part of the present invention.

As a result of the actual installation of large numbers of porous plates, in which I encountered practical difficulties in the use of latex compounds for the purpose described, I have improved on the methods used, and have invented additional means for both reducing the cost of such work and for producing a modified joint which is more easily removable.

The difficulties experienced in such use of latex compounds of the type described, which are completely obviated by the improvements hereinafter set forth, are as follows:

The joint between the diffuser plate and the adjoining walls of the supporting structure ordinarily depends wholly upon the adhesive properties of the solidified latex compound and its resistance to a shearing couple. This is due to the fact that the surfaces joined, namely the edge surface of the plate and the nearest adjoining surface of the holder, are ordinarily both parallel to the vertical thrust of air pressure on the plate. Under this condition, a very strong adhesive bond and good resistance to shear are essential. In order to obtain these characteristics, it is necessary to use a concentrated latex in combination with a high percentage of aluminous cement, as previously described. Very little inert filler can be used. The dry ingredients must be stirred into the latex just prior to pouring into the joint.

Smaller amounts of aluminous cement permit the rubber to cure with greater elasticity, which causes it to be subject to easy removal from the joint by the pressure of air, in much the same manner as has been found to be true with ordinary rubber gaskets. However, the use of sufficient aluminous cement to avoid this difficulty, ordinarily has the secondary effect of causing rapid thickening and solidification of the mixture, due to removal of water from the latex by hydration. This thickening makes it difficult to pour any of the compound which has been mixed for more than ten to fifteen minutes, and progressively slows the pouring process during that time.

The result is a repetition of delays in the pouring operation, and requires special skill to adjust the rate of mixing to the rate of pouring when a crew of workmen is being used. Unavoidably, a considerable part of the mixture sets up before it can be poured, causing a loss of material. Such loss cannot be recovered, as it is impossible to redisperse latex which has been solidified under these conditions. This loss of time and material has a decided bearing on the cost of such work, and makes the process more difficult for workmen who have not had special training in handling such compounds.

The requirement of exceptionally good adhesion and high resistance to shear also restricts the use of inert fillers, as mentioned above, making the cost of material higher than in most rubber compounding.

Aside from the above difficulties which increase the cost of installation, it was found that certain other deficiencies inherent to my original method increased the cost of removal, as follows: Upon removing a diffuser plate by rupturing the joint as previously described, practically all of the solidified latex compound adhered either to the edges of the plate or to the holder. This re-

sulted in ragged edges which effectively prevented replacing of the plate in the holder until a large part of the latex compound had been removed. The removing of these ragged edges, although much easier than the removal of Portland cement joints, still required an expenditure of labor at least equal to that needed for the installation of the plates.

A further difficulty was encountered due to a tendency of the latex composition to run into the space beneath the plates, where moisture is usually present. The presence of such moisture prevented the latex composition from solidifying until such later time as compressed air was blown into this space. Part of the latex was then blown onto the under side of the plates, where it dried and caused a slight amount of clogging of the porous plates. Additional clogging was caused by occasional accidental spilling of drops of the latex compound on the tops of the plates, from which it was difficult to remove due to its strong adhesive properties.

The great need for an improvement over the ordinary methods of fastening diffuser plates is evidenced by the fact that, in spite of the deficiencies of my original method of using latex for this purpose, said method is at the present time considered by designing engineers of sewage disposal plants to be the best known method in use, and is being specified for additional work in preference to all other well known fastening means.

However, in order to obtain the maximum advantages from the use of latex compounds for this purpose, it was necessary to overcome all of the objections above described, without introducing new difficulties.

By experiment, I found that a change in the shape of the edge of the plates, and also in the nearest adjoining surface of the holders, such as to cause the joint compound to be put in compression as well as in shear by an upward thrust of the plates, permits the use of a locking type of joint which greatly simplifies all the problems mentioned. I also found that such locking type joints permit the use of latex compounds having good resistance to compression, a smaller resistance to shear, and less adhesion than previously required. These characteristics can readily be obtained in a rubber-like composition having a high percentage of inert filler, and a smaller percentage of aluminous cement than had previously been used. Joints of this type also permit the use of such proportions of latex rubber and aluminous cement as will avoid premature stiffening of the mixture.

I further improved the means for removing the joint compound from the joint, employing, instead of a means for rupturing the joining material, a flexible member embedded under said material, by means of which a strong outward pull could be applied to said material to withdraw it from the joint. The outwardly pulling force is applied progressively along the entire length of said joint as the joining material is removed by a peeling action, so that, by a simple and rapid operation, the entire joint is opened. The porous plates can then be lifted out without danger of breakage, with little or no remaining joint material to be cleaned from the edge surface of the plate or from the adjoining surfaces of the holder.

I also found that, by making possible the use of a joining material having less adhesion, it was possible to easily remove any such material as might be accidentally spilled on a diffusing surface of a porous plate.

A further improvement was made to avoid the flowing of the joining material, in its liquid state, into the space under the plates, where it could at a later time partially clog the plates. This consisted of a compressible gasket or seating medium, located between said plate and the supporting structure thereunder, in such a manner as to not only cut off such undesirable flow of joining compound, but to also serve as a resilient base upon which to rest the porous plate. This feature is considered to be of special value in connection with the use of carbon plates, which are best prevented from breakage by such resilient mountings.

The rubber composition to be used in the improved locking type joint may be any compound of latex which will give the required characteristics. It may also be formulated with a base of reclaimed rubber dispersed in water, dispersed "Neoprene," "Buna," or other rubber-like materials, or a combination of such dispersed materials and latex.

For some porous plates, such as those made of silica grains or Carborundum, a fairly hard and unyielding joining compound can be used, while for other types of porous mediums, such as those made of carbon, it is often desirable to use a more resilient joining compound, to form a cushion which will effectually equalize the pressure exerted by the joint on the porous medium.

Also, in the use of such compounds in connection with locking type joints, it is desirable to use a joining material having greater or less adhesion and resistance to shear, depending on the angle of the joint, as will be described later.

It is possible to not only control the resiliency, adhesion, and resistance to shear of the joining compound, but also to effectively control the length of time required for setting, by adjusting the composition of the mix.

For example, a hard and unyielding compound, having good adhesion to porous plates and concrete, sufficient resistance to shear, and retarded setting, can be formulated as follows: Rubber, as contained in concentrated latex having 70% to 72% solids, 72 parts; water, in addition to that contained in the latex, 6 to 8 parts; into this is mixed the following powder: silica flour, 80 parts; aluminous cement, 95 parts; sulphur, 3 parts; zinc oxide, 2 parts; tetramethylthiuramdisulfide, 1 part. After this has been thoroughly incorporated into the mix, from 100 to 300 parts of slightly damp builder's sand is stirred into the compound, the amount of sand used being limited by the desired fluidity of the mix for pouring. In place of damp sand, which is often composed of rounded granules which do not adhere well to the rubber, it may be found more satisfactory to use ground flint, marble, granite, or other granular filler of such approximate size as will pass through a 20-mesh screen. Such ingredients will hereinafter be known as "granular filler."

The above composition can be made more resilient, and the adhesion reduced for easy withdrawal from a joint, by decreasing the proportion of aluminous cement to approximately 70 to 80 parts, or to even less than that amount. However, such reduction of aluminous cement increases the rubber content of the compound, correspondingly increasing the cost.

A more suitable method of accomplishing the desired result is to substitute a reclaim rubber

dispersion in water for part of the latex. For example, the following composition can be used for this purpose: Rubber, as contained in concentrated latex having 70% to 72% solids, 72 parts; reclaim rubber, as contained in a water dispersion having 42% solids, 42 parts; into the combined latex and reclaim dispersion is mixed the following powder: aluminous cement, 320 to 350 parts; sulphur, 5 parts; zinc oxide, 3 parts; tetramethylthiuramdisulfide, 2 parts. To this mixture add damp builder's sand or granular filler up to 400 parts, the amount to be used depending upon the desired fluidity of the mix. This compound can be readily adjusted for additional resiliency and reduced adhesion, by substituting for part of the aluminous cement an inert filler, such as ground silica, clay or whiting.

In general, a reduction in the proportion of aluminous cement and an increase in the total water content of the mix causes a retardation in the rate of setting, to prevent loss of time and material. As a further illustration of a composition of the type recommended for quick removal from joints, but also having sufficient body to effectively hold porous mediums in place in locking type joints where the solidified composition is largely in compression, the following compound can be used: Rubber, as contained in a concentrated latex having 70% to 72% solids, 72 parts; reclaim rubber, as contained in a water dispersion having 42% solids, 10 parts; water, in addition to that contained in the latex and dispersion, 15 parts. To the above mixture is added the following powder: Silica flour, 75 parts; aluminous cement, 70 parts; sulphur, 3 parts; zinc oxide, 2 parts; tetramethylthiuramdisulfide, 1 part; granular filler, up to 200 parts, depending upon the desired fluidity of the mix for pouring.

This composition represents the approximate upper limit of water content which can be employed in a formulation of this type. Under these conditions, lengthy air drying is necessary, as the aluminous cement is incapable of combining with all of the water present. Although this mixture can be readily poured for a greatly increased time without stiffening of the mix, final solidification is similarly delayed, due to the necessity for air drying, followed by curing of the rubber at normal temperatures. Approximately one week should be allowed after pouring for this composition to gain adequate strength. The possibility of cracking of the joining material due to shrinkage while drying is also a limiting factor in the amount of water to be used.

Additional ingredients can be added to any of the above compositions or to their intermediate variations, to give special attributes to the resulting joint. For instance, if the jointing material is to be subjected to exposure to oxygen, any of the well known antioxidants, such as phenyl-beta-naphthylamine, can be used.

Stabilizers, such as "Saprotin," casein solutions, and other well known commercial latex stabilizers, can be used to good advantage in small amounts to retard coagulation while mixing.

The selection of accelerator can be varied if desired. In particular, the zinc salt of dibutyl dithiocarbamate acid has been found to give good results.

If it is desired to produce a joining compound which will have greater tensile strength to facilitate withdrawal from the joint, short strands of fibre, such as glass fibre, fine aluminum shavings, or hemp fibre, can be added to the mix.

Dispersions of "Neoprene," "Buna," or other synthetic rubbers, or latices of these materials, can be substituted for part or all of the natural latex to obtain the benefit of special properties of these materials, such as longer life and resistance to oils.

Any composition which can be poured into joints of the type described in a liquid form, and which will, within a reasonable time thereafter, solidify into a joining material which will effectively seal the joint, and which is capable of being removed therefrom by a means such as is herein described, should be considered as suitable for use in the method for fastening porous mediums described in this specification. Such composition should preferably be resilient, elastic, adherent, and resistant to compressive and shearing forces, possessing each of these properties in such a degree as is suitable for the purposes described herein.

The means by which these improvements are carried out will be apparent from the following additional description and the drawing herewith. The drawing is presented to illustrate a suitable device by which the process of the present invention may be carried out. They are in diagrammatic form, and the invention is not to be limited to the specific designs shown therein.

Referring to the drawing, Figure 1 is a diagrammatic illustration in sectional elevation of the edge of a porous plate in a diffuser apparatus and the nearest adjoining part of the supporting structure, fastened together with a joining material.

Figure 2 is a diagrammatic illustration in sectional elevation of a locking type joint between the edge of a porous plate and the adjoining supporting structure. An optional feature of Figure 2 shows a flexible member embedded in the joining material for the purpose of removing said joining material easily from the joint. Another optional feature of this figure shows a resilient gasket supporting the porous plate.

Figure 3 is a diagrammatic illustration in sectional elevation of a modified licking type joint, in which a projecting part of the supporting structure assists in preventing the removal of the joining material except by the use of means provided therefor.

Figure 4 is a diagrammatic illustration in sectional elevation of a joint similar to that shown in Figure 1, with a means for cutting instead of rupturing the joining material.

Figure 5 is a diagrammatic illustration in sectional elevation of a locking type joint similar to that shown in Figure 2, embodying a greater concentration of pressure on the joining material.

Figure 6 is a diagrammatic illustration in sectional elevation of a locking type joint embodying a multiplicity of pressure and shear areas in the joining material, with means for cutting the joining material to permit the removal of the porous medium.

Referring to the drawing in greater detail, Figure 1 is representative of a type of joint ordinarily made between the edge 1 of a porous plate 23, and the nearest adjoining surface 2 of a plate holder 22. Said holder 22 may be of concrete, in which case it is usually an integral part of the structure of a large tank, or it may be of materials such as aluminum or any other of the rust resistant metals in general use. Pipe 24 is a

source of supply of air under pressure diffused into fluid 25. The space occupied by the joint material 3, has heretofore ordinarily been filled with a Portland cement mixture, a gasket or the like. In the present improved method for fastening porous plates, the joint material 3 is a rubber-like composition of a type previously described, having strong adhesive properties and good resistance to shear.

An aluminum wire 4, or other flexible means for rupturing the joint material 3, is embedded near the bottom of the space occupied by said joining material 3, and arranged so that at least one end of this wire 5 can easily be grasped in a manner for applying an outwardly pulling force thereto of sufficient strength to rupture said joining material.

In the locking type joint shown in Figure 2, the edge 6 of porous plate 23 and the nearest opposite surface 7 of the supporting structure 22 are beveled in such a manner that a joining material 3 filling the joint therebetween in put in compression as well as in shear by an upward thrust of porous plate 23. Any shape of the edge of the porous plate 23 or the opposite surface 7 of the supporting structure 22 which will cause the joining material 3 to be held more tightly in position when an upward thrust is exerted upon it by the plate 6, may be used, provided that the joining material can be withdrawn by a means provided therefor, or by a strong peeling action such as is not encountered in any normal usage of the porous plate.

A peeling action of this character can be applied by grasping the joining material with any type of hook, pliers, or the like, and exerting an outwardly pulling force, provided that the joining material has been compounded with sufficient tensile strength for this operation. Otherwise the withdrawing force can be applied to the joining material by means of a flexible member 9 embedded in the joint, having at least one protruding end 10. This flexible member may be in the form of a tape, such as of woven glass fibre or other durable material having good tensile strength, or in the form of a metal strip having resistance to corrosion and rust.

The joining material in Figure 2 should be of a composition having good resistance to compression, adequate resistance to shear, and sufficiently strong adhesion to porous plate surface 6 and holder surface 7 to prevent its being dislodged or removed by air or other pressure under the plate, or by an upward thrust of the plate such as would result from any condition occurring while the plate is in service. This material should not, however, have sufficient adhesion to porous plate surface 6 and holder surface 7 to prevent its removal in the manner described. This material should preferably be poured into the space as a liquid, and should solidify and reach its required strength within a reasonable time thereafter.

A gasket 11 of resilient material, such as sponge rubber, is shown under the edge of the porous plate 23 to prevent the liquid joining material from flowing through irregularities under the plate into space 12. This gasket also serves as a cushion to equalize the pressure on the under side of the porous plate 23 along the edge of support. The use of such resilient gasket is optional, depending upon the presence of irregularities in that part of the holder immediately under the edge of the porous plate.

The shape of the holder surface 14 shown in Figure 3 is such that a constriction is present in the upper part of the joint, such as would increase the resistance to the removal of a joining material 3 from the joint, especially under conditions of upward thrust of the porous plate. Such upward thrust would result in a concentration of pressure upon the joining material in the vicinity of the upper part of surface 14, tending to clamp the joining material in place, and thus prevent the removal of the porous plate by such an upward thrust as would normally be encountered in service. In joints of this type, the joint can be filled with a somewhat resilient joining material, having less adhesion than otherwise would be required. Examples of compositions having these characteristics have been described herein. The use of a flexible member 9, with at least one protruding end 10, is of great value in withdrawing the joining material by forcing it through the constricted upper part of the joint.

A cutting medium 15, shown in Figure 4, can be used instead of an ordinary wire or the like 4 shown in Figure 1, in connection with the use of joining materials which are extremely resistant to shear, and for those which contain short lengths of fibre or the like, through which a wire would not readily pass. It is intended that the wire or cutting member can be used interchangeably with each other or with the flexible member 9 in any variations of the joints described herein, depending upon which is best suited to the combination of joint structure and joining material being used.

Figure 5 shows another method of concentrating the pressure on a limited area of the joining material, so as to produce a clamping action due to an upward thrust of the porous plate. In this case a somewhat greater slope is used for the edge 16 of the porous medium 23, and for the opposite edge 17 of the holder 22. By the use of such increased angle in only the upper part of the joint, the pressure on the joining material 3 due to an upward thrust of the porous plate is restricted to a smaller area, and more effectively clamps the joining material into place. A withdrawing means 9 and a protruding end thereof 10, and a resilient gasket 11, are shown. These members are similar to those shown in Figure 2, and are repeated in Figure 5 as an illustration of typical combinations of the various features described herein, which may be arranged in any desired combination to meet the requirements of various operating conditions. A joint of the type shown in Figure 5 will give good results with a slightly resilient joining material having good resistance to shear and reduced adhesion, these properties being obtainable as previously described herein.

In Figure 6, means are provided for applying compressive forces to more than one part of the joining compound, by the introduction of properly spaced ridges, such as at 18, 19, 20 and 21, in the joined surfaces. This has the effect of multiplying the locking action and can, for example, be used with a joining material with which it is not desirable to rely on a single area of compression for the clamping effect. Such ridges also have the effect of increasing the area of the adhering surfaces, thus obtaining a greater over-all binding action without increasing the adhesive properties of the joining material. The ridging can be on either or both joined surfaces, and can be of any design which effectively multiplies the compressive binding action, or increases the surface of ad-

hesion, whereby the strength of the joint is increased. The cutting member 15 with protruding extension 16 may be omitted or interchanged with any other withdrawal means described herein, as may be found most suitable for the conditions of usage.

I claim:

1. In apparatus for diffusing a first fluid into a second fluid under pressure, a porous member having an upstream surface subjected to a supply of said first fluid under pressure, and a downstream surface subjected to the second fluid at a lower pressure, for passing said first fluid from the upstream to the downstream surface; means for removably securing said member in place comprising an edge surface of said porous member beveled inwardly toward the downstream surface, a supporting structure having a surface opposite said edge surface and suitably spaced therefrom, and shaped to substantially conform with said edge, a resilient joining composition between said edge and structure and adhering thereto, said composition comprising material selected from the group consisting of latex rubber, dispersed reclaimed rubber and synthetic rubber, said material being admixed with aluminous cement, and said supporting structure providing an abutting surface in contact with said upstream surface of said member adjacent to said edge to support said porous member at times when no pressure is applied to said first fluid.

2. In apparatus for diffusing a first fluid into a second fluid under pressure, a porous member having an upstream surface subjected to a supply of said first fluid under pressure, and a downstream surface subjected to the second fluid at a lower pressure, for passing said first fluid from the upstream to the downstream surface; means for removably securing said member in place comprising an edge surface of said porous member beveled inwardly toward the downstream surface, a supporting structure having a surface opposite said edge surface and suitably spaced therefrom, a resilient joining composition between said edge and structure and adhering thereto, said composition comprising material selected from the group consisting of latex rubber, dispersed reclaimed rubber and synthetic rubber, said material being admixed with aluminous cement, and a flexible withdrawing means embedded in said composition for rupturing said securing means; said supporting structure providing an abutting surface adjacent to said upstream surface of said member near said edge to support said porous member at times when no pressure is applied to said first fluid.

3. In apparatus for diffusing a first fluid into a second fluid under pressure, a porous member having an upstream surface subjected to a supply of said first fluid under pressure, and a downstream surface subjected to the second fluid at a lower pressure, for passing said first fluid from the upstream to the downstream surface; means for removably securing said member in place comprising an edge surface of said porous member, a supporting structure having a surface opposite said edge surface and suitably spaced therefrom, a resilient joining composition between said edge and structure and adhering thereto, said composition comprising material selected from the group consisting of latex rubber, dispersed reclaimed rubber and synthetic rubber, said material being admixed with aluminous cement; and said supporting structure providing an abutting surface adjacent to said upstream surface of said member near said edge to support said porous member at times when no pressure is applied to said first fluid.

4. In apparatus for diffusing a first fluid into a second fluid under pressure, a porous member having an upstream surface subjected to a supply of said first fluid under pressure, and a downstream surface subjected to the second fluid at a lower pressure, for passing said first fluid from the upstream to the downstream surface; means for removably securing said member in place comprising an edge surface of said porous member, a supporting structure having a surface opposite said edge surface and suitably spaced therefrom, a resilient joining composition between said edge and structure and adhering thereto, said composition comprising material selected from the group consisting of latex rubber, dispersed reclaimed rubber and synthetic rubber, said material being admixed with aluminous cement, and a flexible withdrawing means embedded in said composition for rupturing said securing means; said supporting structure providing an abutting surface adjacent to said upstream surface of said member near said edge to support said porous member at times when no pressure is applied to said first fluid.

5. In apparatus for diffusing a first fluid into a second fluid under pressure, a porous member having an upstream surface subjected to a supply of said first fluid under pressure, and a downstream surface subjected to the second fluid at a lower pressure, for passing said first fluid from the upstream to the downstream surface; means for removably securing said member in place comprising an edge surface of said porous member, a supporting structure having a surface opposite said edge surface and suitably spaced therefrom, a resilient joining composition between said edge and structure and adhering thereto, said composition comprising material selected from the group consisting of latex rubber, dispersed reclaimed rubber and synthetic rubber, said material being admixed with aluminous cement; said supporting structure providing an abutting surface parallel to said upstream surface of said member near said edge to support said porous member at times when no pressure is applied to said first fluid; and a gasket between said abutting surface and said upstream surface.

6. In apparatus for passing a fluid under pressure through a porous medium, a porous member having an upstream surface subjected to a supply of said fluid under pressure, and a downstream surface subjected to the fluid at a lower pressure, for passing said fluid from the upstream to the downstream surface; means for removably securing said member in place comprising an edge surface of said porous member beveled inwardly toward the downstream surface, a supporting structure having a surface opposite said edge surface and suitably spaced therefrom, a resilient joining composition between said edge and structure and adhering thereto, said composition comprising material selected from the group consisting of latex rubber, dispersed reclaimed rubber and synthetic rubber, said material being admixed with aluminous cement; and said supporting structure providing an abutting surface adjacent to said upstream surface of said member near said edge to support said porous member at times when no pressure is applied to said fluid.

7. In apparatus for passing a fluid under pres-

sure through a porous medium, a porous member having an upstream surface subjected to a supply of said fluid under pressure, and a downstream surface subjected to the fluid at a lower pressure, for passing said fluid from the upstream to the downstream surface; means for removably securing said member in place comprising an edge surface of said porous member, a supporting structure having a surface opposite said edge surface and suitably spaced therefrom, a resilient joining composition between said edge and structure and adhering thereto, said composition comprising material selected from the group consisting of latex rubber, dispersed reclaimed rubber and synthetic rubber, said material being admixed with aluminous cement; said supporting structure providing an abutting surface adjacent to said upstream surface of said member near said edge to support said porous member at times when no pressure is applied to said fluid.

8. In apparatus for passing a fluid under pressure through a porous medium, a porous member having an upstream surface subjected to a supply of said fluid under pressure, and a downstream surface subjected to the fluid at a lower pressure, for passing said fluid from the upstream to the downstream surface; means for removably securing said member in place comprising an edge surface of said porous member, a supporting structure having a surface opposite said edge surface and suitably spaced therefrom, a resilient joining composition between said edge and structure and adhering thereto, said composition comprising material selected from the group consisting of latex rubber, dispersed reclaimed rubber and synthetic rubber, said material being admixed with aluminous cement, and a flexible withdrawing means embedded in said composition for rupturing said securing means; said supporting structure providing an abutting surface adjacent to said upstream surface of said member near said edge to support said porous member at times when no pressure is applied to said fluid.

9. In apparatus for diffusing a first fluid into a second fluid under pressure, a porous member having an upstream surface subjected to a supply of said first fluid under pressure, and a downstream surface subjected to the second fluid at a lower pressure, for passing said first fluid from the upstream to the downstream surface; means for removably securing said member in place comprising an edge surface of said porous member, a supporting structure having a surface opposite said edge surface and suitably spaced therefrom, a resilient joining composition between said edge and structure and adhering thereto, said composition comprising an elastic, stretchable, waterproof, adhesive material, said material being admixed with a quick-setting mineral cement; and said supporting structure providing an abutting surface adjacent to said upstream surface of said member near said edge to support said porous member at times when no pressure is applied to said first fluid.

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