Nov. 27, 1956 L. F. BRAMBLE 2,771,745

ASPHALT LINING

Filed Aug. 25, 1952 2 Sheets-Sheet 1

Fig. 1

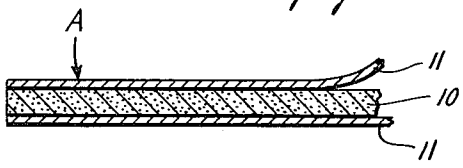

Fig. 2

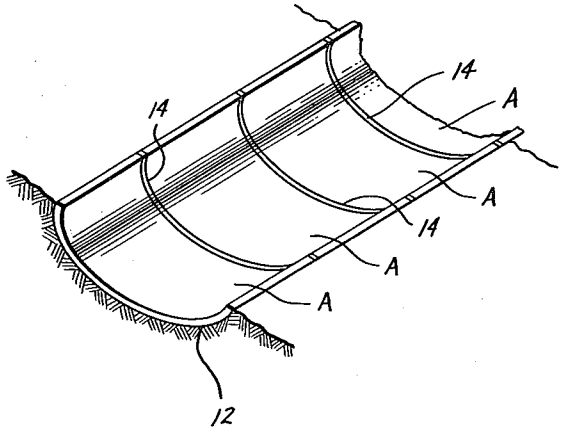

Fig. 3

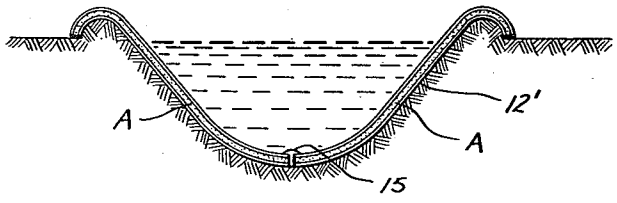

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Fig. 4.

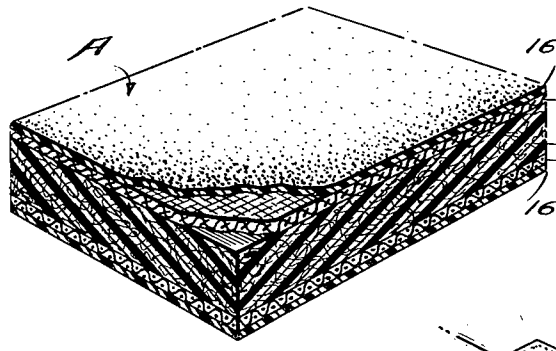


Fig. 5.

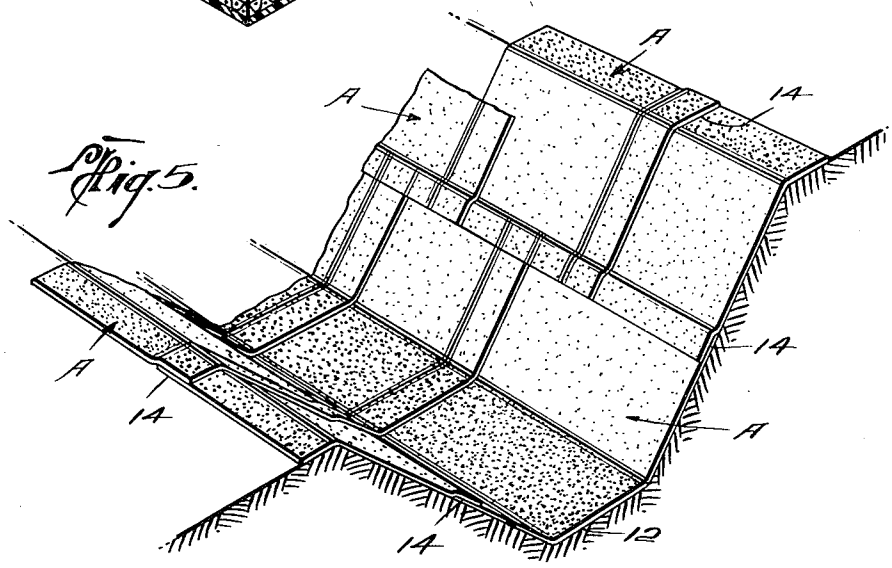
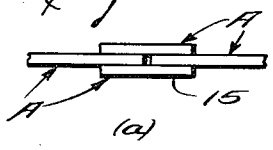


Fig. 6.



(a)

Fig. 7.

(b)

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United States Patent Office 2,771,745 Patented Nov. 27, 1956

2,771,745

ASPHALT LINING

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Application August 25, 1952, Serial No. 306,159

4 Claims. (Cl. 61—7)

This invention relates to new and useful improvements in the asphalt lining of ditches, canals, reservoirs and the like, and particularly irrigation ditches.

For many years, ditches, canals and reservoirs have been lined with concrete in order to render them waterproof to thereby enable liquids such as water to be confined against drainage into the earth therebelow. It has long been recognized that concrete and macadamized linings are unsatisfactory because of the cracks which develop after relatively short periods of use. These cracks may be filled in with an asphalt mastic in order to avoid loss of the liquid or to prevent contamination thereof by seepage, but the treatment is entirely temporary, lasting a maximum of two to three years. Additionally, concrete is often too expensive for practical use, particularly in long irrigation ditches.

Efforts have been made in the past to develop asphalt linings to substitute for the concrete linings for ditches, canals, reservoirs, and the like, but while various types of asphalt linings have been tried, none have proven successful for above-surface application. One of the main problems in providing asphalt linings for irrigation ditches has been to provide a product which will withstand the weight of cattle and the sharp edges of their hoofs as irrigation ditches usually run through areas in which cattle are grazing and unless the entire length of the ditch is fenced, the cattle inevitably get in them. Not only must the linings be able to withstand the effects of cattle without tearing, puncturing or otherwise being damaged, but such linings must also remain substantially non-shrinking and non-cracking over a large temperature range. Additionally, the linings must be sufficiently pliable to be laid in relatively large sheets to reduce the danger of separation between adjacent sheets due to normal expansion and contraction thereof, as well as to reduce the cost of the initial laying of the lining in the ditch.

All of the prior art attempts to develop a satisfactory asphalt lining for irrigation ditches have met with practical failure. For example, applicant has in mind one patent in which the patentees disclose an asphalt lining which has a hard prepared mastic formed on a burlap or webbed material impregnated with a relatively soft asphalt. The mastic is so brittle and hard that it would normally crack. In fact, the mastic is almost exactly the same as the usual macadamized road pavement. The relatively soft asphalt in the webbed material is, in theory, supposed to overcome the deficiencies of the hard and brittle mastic, but as a practical matter, the cracks which are formed are immediately filled with dust or silt, so that even though the soft asphalt, through pressure or some other unlikely possibility, was forced into the cracks, the dust or silt would prevent its adherence to the mastic, and it would lose its effectiveness as a sealer.

Also, due to the hard and brittle nature of the lining disclosed in this patent, it must be used in small squares or pieces, and must be bent or curved by applying a force

to the pieces while they are suspended on rollers. Furthermore, due to the hard and brittle nature of lining, the ditches must be perfectly contoured before laying the lining and the sheets of lining must be precisely shaped to the contour of the ditch or other surface. Otherwise, voids in the surface of the ditch will result in large cracks which cannot possibly be self-sealed. Also, any misalignment of the sheets in the ditch results in large cracks. As will be appreciated, the tailor-made construction required is far too expensive for practical use. It has also been disclosed in the prior art how, in an attempt to solve the problem of employing asphalt linings for ditches, a very soft asphalt of the type employed for many years has been applied hot, to form a membrane for waterproofing and erosion resistant purposes. The asphalt is applied hot in a very thin layer (about 1/8 to 3/16 inch in thickness) to a sulphite paper backing. The paper backing serves only to hold the asphalt together for rolling prior to use in a ditch, and, in fact, the asphalt is too soft for handling in any manner without the paper backing. Although such a lining is readily curved to the contour of the ditch surface or the like without the careful workmanship required by other linings of the prior art, it is readily torn or split by cattle hoofs, etc., and is extremely soft so that it will actually flow at maximum sun temperatures. To avoid this, the aforesaid disclosure teaches that the lining shall be buried under a heavy layer of soil. This, however, is totally unsatisfactory since, except for a relatively small amount of the dirt which may adhere to the asphalt, the dirt is constantly shifting, being washed away by the water flowing in the ditch or being dislodged by the cattle. Also, in practice, should it develop during the step of applying the hot asphalt, that drops of rain water fall upon the lining, blisters will form and pin holes will follow, thus giving rise to a somewhat pervious lining.

It is therefore an object of this invention to provide an asphalt lining for irrigation ditches and the like wherein the lining is substantially non-shrinking, non-curling, non-cracking, is readily curved without cracking even in large strips or sheets, and is capable of withstanding the weight and cutting action of cattle hoofs without puncturing or tearing.

An important object of this invention is to provide a composite monolithic asphalt dimensional non-shrinking lining, and a method of lining a ditch or reservoir with the same, wherein the lining includes an enduring tough, cohesive pliable plastic asphalt composition which is molded, extruded or pressed between outer layers of reinforcing material, which lining is substantially non-shrinking, non-curling, non-cracking, and has a high resistance to impact or knifing action such as caused by the hoofs of cattle or other stock, and provides a lining that may, if need be, be applied upon a damp surface without giving rise to any blisters, since the lining is preformed.

Another object of this invention is to provide an asphalt lining having an asphalt composition layer which has mixed therewith filler and fiber material including fibers of materials such as shredded, ground or pulverized roofing felt or asbestos, mineral fillers such as slate flour, limestone, or talc, and organic products, such as sawdust, rice hulls, peanut hulls or cork, said filler material constituting about 20% to 60% of the mastic layer; a filler material preferably not exceeding 35% having produced a most acceptable product.

A further object of this invention is to provide a composite monolithic asphalt lining having a mastic layer of substantially pliable and plastic non-cracking material, which layer is reinforced by two intermediate layers of webbing material, and said intermediate layers are coated with a substantially thin outermost weathering asphalt waterproof coating layer to fill the interstices of the

webbing material and to prevent shrinkage thereof upon exposure to the weather.

A still further object of this invention is to provide a method of lining ditches and canals such as irrigation ditches wherein the sub soil of the ditch or canal is treated with weed killer, the particular asphalt lining of this invention is laid in sheets transversely or longitudinally of the length and breadth of the ditch with the adjacent sheets either abutting or overlapping, the joints between adjacent sheets being sealed with asphalt.

The construction designed to carry out the invention will be hereinafter described together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown, and wherein:

Figure 1 is a sectional view illustrating the construction of the preferred form of the asphalt lining of this invention.

Figure 2 is an isometric view, illustrating the use of the asphalt lining of this invention for the lining of a relatively small width irrigation ditch.

Figure 3 is a sectional view illustrating the use of the asphalt lining of this invention as it may be used for lining relatively large width irrigation ditches.

Figure 4 is a more detailed view of the sectional view shown in Figure 1.

Figure 5 is an isometric view, as in Figure 2, illustrating the use of the asphalt lining of this invention for the lining of an irrigation ditch, canal, reservoir, or the like.

Figure 6 shows in detail, the manner of joining abutted sheets of the material including overlapping or underlapping strips in the region where the sheets abut; and

Figure 7 shows in detail, another method to be employed in joining abutting sheets of the material.

In the drawings, the letter A designates generally the asphalt lining of this invention. This lining A is substantially non-curling, non-shrinking, non-cracking, is of sufficient strength to withstand the cutting action of cattle hooves, and is sufficiently pliable over a temperature range from about freezing to about 200 degrees Fahrenheit to be conformed to the contour of a ditch without cracking. Additionally, it has been found that the asphalt lining of this invention is very durable and is not subject to cracking even after long periods of exposure to the natural elements such as the sun, hail and other weather conditions.

The asphalt lining A of this invention includes an asphalt composition layer **10** which is disposed between intermediate reinforcing layers **11**. The asphalt mastic composition layer **10** is a tough cohesive mastic, moulded, extruded, or pressed between the two intermediate layers **11** of reinforcing material. This reinforcing material may consist of paper such as kraft paper, of felt, metal wire, glass fabric or glass gauze. In the formation of the monolithic composite asphalt lining A, the asphalt layer **10** being adhesive may be bonded to the reinforcing layers **11**, and may be caused to partially penetrate into the intermediate layers of reinforcing material **11** a sufficient distance to bond such layers thereto. The primary purpose of the reinforcing layers **11** is to hold together the mastic layer **10** until the mastic has had an opportunity to cool and harden sufficiently to permit its subsequent handling and trimming to the sheet sizes required. To some extent, of course, the reinforcing layers **11** also add strength and impact resistance to the composite monolithic lining A.

The asphalt mastic which is used to form the composition mastic layer **10** of the lining A includes a special asphalt mixed with filler material such as fibres, mineral fillers and organic binders. The asphalt of which the mastic is formed preferably is of the catalytically blown asphalt of the type set forth in U. S. Patent 2,450,756 granted to A. J. Hoiberg, on October 5, 1948. Although the catalytically blown asphalt is preferred, air blown and natural asphalt may be utilized. The asphalt preferably employed has the following broad physical characteristics:

	Min.	Max.
Melting Point, B and R	140	220
Penetration @ 77° F	10	90
Penetration @ 32° F	10	115
Flash Point, C. O. C	400	650
Solubility in CS_2, percent	90	100

Although the above table lists the broad physical characteristics which are suitable for the asphalt used in forming the mastic, it is preferred that the following physical characteristics be present in the asphalt used for forming the mastic:

	Min.	Max.
Melting Point, B and R	180	220
Penetration @ 77° F	20	55
Penetration @ 32° F	20	40
Flash Point	500	600
Solubility in CS_2, percent	98	100

In order to provide a pliable and plastic, non-cracking mastic layer **10** of sufficient strength to withstand the cutting action and weight of cattle hooves and other stock, the asphalt has mixed therewith fillers in the amount of about 20–60 percent. Filler materials which are suitable for forming a non-cracking and high strength mastic layer are: Fibers such as roofing felt which has been either ground, shredded, pulverized or added in sheet form and subjected to the disintegrating action of the continuous mixer when mixing the fibers with the asphalt. The fibers may also be obtained from asbestos or the like. Mineral fillers are also suitable and are used in addition to the fibers since they add to the further build-up of the cohesive strength pliability and plasticity when properly admixed and examples of such mineral fillers are slate flour, limestone, talc, silica, and the like. Also in addition to the fibers and the mineral fillers, it is preferable to use an organic binder or product such as sawdust, rice hulls, peanut hulls, or cork. These organic products also add to the cohesive strength pliability and plasticity and workability of the resulting mastic. The asphalt composition layer **10** includes fibres, mineral fillers and organic binders in the following preferred percentages: Asphalt 70%; mineral fillers 20%; fibrous material (mixture of fibers and organic binder) 10%.

The resulting asphalt composition obtained after the intimate admixture of the filler materials with the asphalt, is pliable and plastic at even zero temperatures, and has a particularly high flow point. Following is a table of the physical characteristics of the resulting asphalt composition product as it is used to form the composition layer **10**:

Water absorption—Less than 5% by weight

Brittleness—The integrated or completed layer shall not crack or shatter when subjected to the impact of a one pound iron ball dropped a distance of three feet at 0° F.

Distortion—A 4" square sample maintained in a horizontal position for two hours at 150° F. shall show no deflection from the horizontal. There shall be no flow when the 4" x 4" specimen is placed on a 45° angle and subjected to 200° F. for 1 hour.

The mastic sheet is preferably formed by continuously moulding the intermediate reinforcing layers **11** into contact with the composition mastic layer **10** when it is hot and in a semi-solid form. This permits the flow of the mastic **10** into the adjacent surfaces of the intermediate layers **11** whereby the intermediate layers **11** are united adhesively with the central mastic layer **10**. The result-

ing sheet is non-cracking and is resistant to impacts such as are caused by cattle or other stock walking thereon. However, in order to assure that the asphalt lining A is non-shrinking and non-curling, an additional outer layer **16** of asphalt waterproof coating should be applied to the intermediate layer **11** which is to be exposed to the weather conditions. This additional asphalt waterproof coating is applied as a liquid or semi-solid and may be applied in a hot liquid state at the time of manufacture of the sheet A. This outer coating also fills the interstices of the intermediate reinforcing material and thereby prevents the shrinkage of such material. It will be appreciated that if the intermediate reinforcing layers **11** shrink, while the composite mastic layer does not shrink, there would result a curling of the entire lining A. The additional asphalt waterproof coating has substantially the same physical characteristics as the asphalt used in forming the asphalt composition layer **10**, although this may be varied somewhat to suit individual or climatic conditions. Into this coating, applied at the time of manufacture, finely divided substances such as mica and rice hulls, may be pressed for the purpose of sun-ray protection, and preventing sticking during shipment.

In the use of the asphalt lining A of this invention, particularly as shown in Figure 4, the lining is formed into sheets of a suitable length and width for the usual irrigation ditch, or for use as desired in canals, reservoirs and the like. In Figures 2 and 5 of the drawings the sheets A are shown after having been laid in an open ditch **12**. It is preferable prior to the laying of the sheets of the asphalt lining A that the ditch be sprayed or otherwise treated with a weed killing material so that weeds will not grow beneath the lining and rupture same. As can be seen, the sheets of lining A are laid with their adjacent edges either abutting or overlapping, Figures 6 and 7, and then an asphalt adhesive material, preferably of asphalt mastic with solvent and having fibers and fillers therewith, is applied to the joints **14** or **15** to seal them. After the joints have been sealed with the adhesive material, the ditch is completely lined and waterproofed and can be used as such.

It has been found that while the asphalt lining A is at least one-quarter of an inch in thicknes, the lining will sustain an animal hoof weight of 500 pounds per hoof without puncturing at 100 degrees Fahrenheit. The lining may vary in thickness from one-fourth of an inch to one inch and still be sufficiently pliable to be shaped to the contour of a ditch or the like.

In Figure 3 there is shown another method of laying the lining, wherein the ditch or canal being lined is of a considerably wider distance than the width of the usual irrigation ditch such as illustrated in Figure 2. The only difference between the method of lining shown in Figure 3 and that shown in Figure 2 is that two sheets or strips are utilized for covering the full width of the ditch and such sheets are joined at the center and the joint is filled with asphalt sealing material as the joints **14** in Figure 2. Such joint at the center of the strips in Figure 3 is designated by the numeral **15**, and the ditch is designated by the numeral **12'**. In any event the sheets may be laid transversely or longitudinally of the length of the ditch. The sheets may also be overlapped from two to three inches as shown in Figure 7 or may be butted one edge against the other as shown in Figure 6. When butted, it may be desirable to place a protective asphalt strip several inches wide underneath or above the joint and the adhesive then applied to the joint.

Although the asphalt composition layer **10** has been described above as having only the two intermediate reinforcing layers **11**, and the outer layers **16**, it could also have a stiffener layer (not shown) centrally embedded within the composition layer **10**, parallel to, but spaced from both of the intermediate layers **11**. This stiffener would develop additional strength, toughness, flexibility, and rigidity which are particularly desirable in the finished product.

Additionally, it should be pointed out that the lining of this invention is not limited to use in irrigation ditches, canals, reservoirs, and the like, but may have various other uses. For example, this lining in addition to its high cohesive strength, and resistance to impact and shock, is especialy resistant to erosion, so that the lining as manufactured is well suited for the protection of dykes and earth retaining walls, and similar uses. In such uses, the wind-wave action is very erosive and prior to this invention, no asphaltic lining has been developed which is sufficiently resistant to such erosion to replace the usual concrete retaining walls. The lining could be anchored in position on the dykes or earth walls by having the upper portion of the lining curved substantially horizontally, with dirt or other fill applied thereover for weight.

It can thus be seen that an asphaltic lining has been provided which has all of the desirable properties necessary for a satisfactory lining for an irrigation ditch or the like, and the particular construction of the asphalt lining eliminates the disadvantages of the prior art. It is believed evident from the foregoing description that the asphaltic lining of this invention is substantially monolithic and is non-cracking even after long periods of use in a ditch with exposure to all weather conditions, and additionally the asphaltic lining is sufficiently pliable and plastic to readily conform to the ditch without the necessity for using special rollers or other forming members to curve the lining. Furthermore, the lining of this invention is of sufficient strength to withstand the impacts or cutting action of cattle hooves without the necessity for an additional surface coating of rocks, gravel or dirt. The asphaltic lining of this invention may be readily laid by unskilled labor without special equipment.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. An asphaltic composite lining for use in lining ditches and the like, comprising a central non-cracking flexible asphaltic composition layer, an upper intermediate layer of reinforcing material impregnated with asphalt and bonded to the upper side of said central composition layer, an upper coating layer of essentially pure asphalt adjacent to said upper intermediate layer and bonded thereto to render said upper intermediate layer non-curling and non-shrinking under weathering conditions, a lower intermediate layer of reinforcing material impregnated with asphalt and bonded to the lower side of said central composition layer, and a lower coating layer of essentially pure asphalt adjacent to said lower intermediate layer and bonded thereto to render said lower intermediate layer non-curling and non-shrinking under weathering conditions, said central asphaltic composition layer consisting essentially of pure asphalt and fillers mixed therewith wherein the asphalt in said central layer is present in an amount of from about 40% to about 80% and the fillers are present in an amount from about 60% to about 20% and wherein substantially all of the fillers is a mixture of fibrous material and pulverized or finely ground mineral fillers, said fibrous material and said mineral filler each being present in said central layer in amounts sufficient to provide the final composite lining which shows no deflection from a horizontal position when subjected to 150° F. for two hours and which also shows no flow when placed on a 45° angle and is subjected to 200° F. for one hour, and which does not crack or shatter when subjected to the impact of a one pound steel ball dropped from a distance of three feet at 0° F., said asphalt in said asphaltic composition layer and in said substantially pure asphalt coating layers having a

melting point (ball and ring) in the range of about 140° F. to about 220° F., and a penetration at 77° F. of from about 55 to about 10, whereby said asphaltic lining is substantially uniformly non-curling, non-cracking, and pliable under sustained weathering and over a temperature range from about freezing to about 200° F.

2. An asphaltic composite lining for use in lining ditches and the like, comprising a central non-cracking flexible asphaltic composition layer, an upper intermediate layer of reinforcing material impregnated with asphalt and bonded to the upper side of said central composition layer, an upper coating layer of essentially pure asphalt adjacent to said upper intermediate layer and bonded thereto to render said upper intermediate layer non-curling and non-shrinking under weathering conditions, a lower intermediate layer of reinforcing material impregnated with asphalt and bonded to the lower side of said central composition layer, and a lower coating layer of essentially pure asphalt adjacent to said lower intermediate layer and bonded thereto to render said lower intermediate layer non-curling and non-shrinking under weathering conditions, said central asphaltic composition layer consisting essentially of pure asphalt and fillers mixed therewith wherein said layer contains about 70% of said pure asphalt, about 20% mineral fillers, and about 10% fibrous material whereby said fibrous material and said mineral filler are present in said central layer in amounts sufficient to provide the final composite lining which shows no deflection from a horizontal position when subjected to 150° F. for two hours, and which also shows no flow when placed on a 45° angle and is subjected to 200° F. for one hour, and which does not crack or shatter when subjected to the impact of a one pound steel ball dropped from a distance of three feet at 0° F., said asphalt in said asphaltic composition layer and in said substantially pure asphalt coating layers having a melting point (ball and ring) in the range of about 140° F. to about 220° F., and a penetration at 77° F. of from about 55 to about 10, whereby said asphaltic lining is substantially uniformly non-curling, noncracking, and pliable under sustained weathering and over a temperature range from about freezing to about 200° F.

3. An asphaltic composite monolithic lining for use in lining ditches and the like, comprising an asphaltic non-cracking composition layer, an intermediate layer of reinforcing material selected from the group consisting of felt, kraft paper, metal wire, glass fabric and glass gauze on each side of said asphaltic composition layer bonding to said intermediate layers, said intermediate layers being coated on their respective outer surfaces with a thin substantially pure asphalt waterproofing and weatherproofing coating to form a composite monolithic sheet which is non-curling under weathering conditions, said asphaltic composition layer consisting essentially of asphalt in the amount of about 65% to about 80% and fibrous filler, mineral filler and organic binder materials in the total amount of about 35% to about 20%, said fibrous filler, mineral filler and organic binder materials each being present in amounts sufficient to provide the final composite lining which shows no deflection from a horizontal position when subjected to 150° F. for two hours, and which also shows no flow when placed on a 45° angle and is subjected to 200° F. for one hour, and which does not crack or shatter when subjected to the impact of a one pound steel ball dropped from a distance of three feet at 0° F., and wherein the fibrous materials are ground, shredded or pulverized fibers selected from the group consisting of felt or asbestos, and the mineral

filler materials are selected from the group consisting of slate flour, limestone, talc, silica, and the organic binders are selected from the group consisting of rice hulls and sawdust, whereby said asphaltic lining is substantially non-curling, non-cracking, and sufficiently pliable and plastic under sustained weathering and over a temperature range from about freezing to about 200° F., said asphalt in said asphaltic composition layer and in said substantially pure asphalt waterproofing coating having a melting point (ball and ring) in the range of about 140–220° F., and a penetration at 77° F. of from about 55 to about 10, whereby the entire lining is uniformly pliable and non-cracking.

4. An asphaltic composite monolithic lining for use in lining ditches and the like, comprising an asphaltic non-cracking composition layer, an intermediate layer of reinforcing material selected from the group consisting of felt, kraft paper, metal wire, glass fabric and glass gauze on each side of said asphaltic composition layer bonding to said intermediate layers, said intermediate layers being coated on their respective outer surfaces with a thin substantially pure asphalt waterproofing and weatherproofing coating to form a composite monolithic sheet which is non-curling under weathering conditions, said asphaltic composition layer consisting essentially of asphalt in the amount of about 40% to about 80% and fibrous filler, mineral filler and organic binder materials in the total amount of about 60% to about 20%, said fibrous filler, mineral filler and organic binder materials each being present in amounts sufficient to provide the final composite lining which shows no deflection from a horizontal position when subjected to 150° F. for two hours, and which also shows no flow when placed on a 45° angle and is subjected to 200° F. for one hour, and which does not crack or shatter when subjected to the impact of a one pound steel ball dropped from a distance of three feet at 0° F., and wherein the fibrous materials are ground, shredded or pulverized fibers selected from the group consisting of felt or asbestos, and the mineral filler materials are selected from the group consisting of slate flour, limestone, talc, silica, and the organic binders are selected from the group consisting of rice hulls and sawdust, whereby said asphaltic lining is substantially non-curling, non-cracking, and sufficiently pliable and plastic under sustained weathering and over a temperature range from about freezing to about 200° F., said asphalt in said asphaltic composition layer and in said substantially pure asphalt waterproofing coating having a melting point (ball and ring) in the range of about 140–200° F., and a penetration at 77° F. of from about 55 to about 10, whereby the entire lining is uniformly pliable and non-cracking.

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