Jan. 22, 1957 L. F. BRAMBLE 2,778,406

ASPHALTIC COMPOSITE MONOLITHIC SHIELD

Filed Sept. 8, 1955

Fig. 1

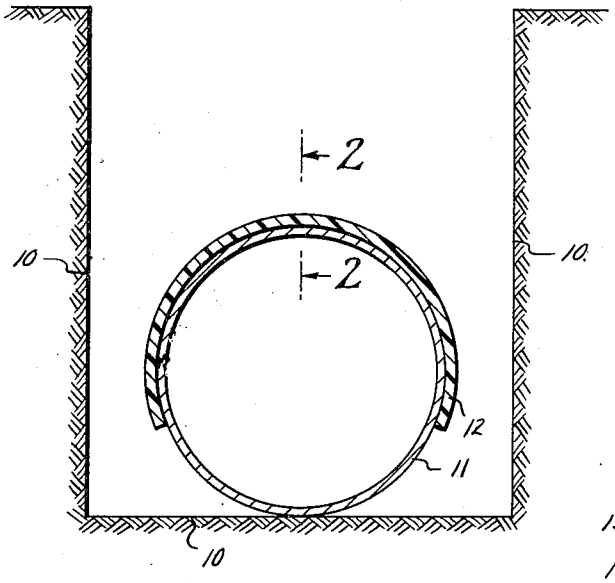


Fig. 2

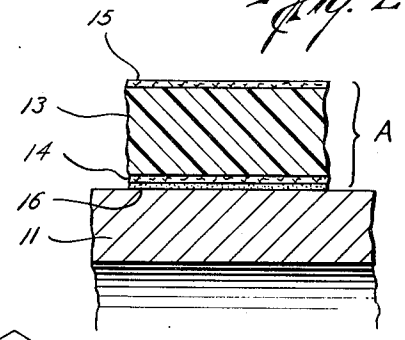
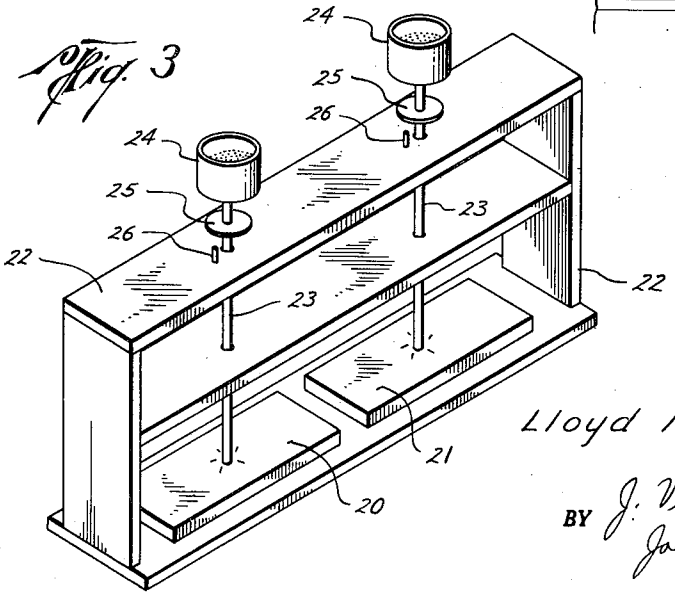


Fig. 3



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ASPHALTIC COMPOSITE MONOLITHIC SHIELD

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3 Claims. (Cl. 154—41)

This invention relates to new and useful improvements in rock shields, and particularly to a new asphaltic composition employed in the manufacture thereof, and to a new method of applying the rock shield to a pipe line.

The prior art shows that it is old to employ rock shields for protecting pipe and the coating on said pipe when the pipe is being laid in rocky areas; to shield a coated pipe at river crossings; to shield a coated pipe when dragging or pulling the pipe through swamps; and to shield a coated pipe whenever and wherever the pipe and its coating are subject to rough handling.

The prior art shows also, that it is old to attach rock shields to a pipe by wrapping the shield or membrane entirely around the pipe after the fashion of applying a cigarette paper to a quantity of tobacco. The shield or membrane is subsequently fastened to the pipe by the use of wire or metal bands. The prior art shows also that the shield or membrane may be applied to the pipe by spirally wrapping the same about the pipe, and by using many obvious methods and means of fastening the shield in place.

The present invention relates particularly to a rock shield that is adapted to protect gas and oil pipe lines, the pipe cross-sections of which frequently range in diameters between twelve and thirty inches, the pipe lines being laid in rough rocky terrain; across swamps and rivers; under highways and railroads; and in fact under many difficult installation conditions. The pipe line must be protected against damage by rocks when backfilling takes place; and any coatings that might have been applied to said pipe line must also be protected from such damage. The function of the rock shield is to resist penetration of rocks or other foreign matter held under constant pressure of the backfill in a ditch after the pipe has been laid.

The present invention is directed to a new asphaltic composition or material employed in the manufacture of the shield and also to a new method of applying that asphalt composition or material to a pipe line.

It is therefore an object of this invention to provide a rock shield for pipe lines wherein the shield is substantially non-shrinking, non-curling, non-cracking, and is readily curved without cracking even in large strips or sheets, and is capable of withstanding the weight and sustained pressure of back-fill material such as rocks and dirt without puncturing or cutting action developing.

An important object of this invention is to provide a rock shield having a central asphaltic composition or mastic layer consisting essentially of asphalt and sand in specified proportions; asphalt comprising from fifteen (15) percent to forty (40) percent of the composition and sand comprising from sixty (60) percent to eighty-five (85) percent of the composition. The important characteristics are both the particle size and particle shape of the sand used, and the asphalt used, whereby the optimum factors of resistance to pressure and resistance to impact of rocks and other damaging things are developed.

A further object of the invention relates to a method

of applying the asphalt material and the shield to a pipe line, during the period of installation of the pipe line.

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

Figure 1 is a sectional view showing a ditch or trench in which a pipe is being laid with the rock shield in place on said pipe;

Figure 2 is an enlarged sectional view of the shield and pipe taken on line 2—2 of Figure 1; and

Figure 3 is an isometric view of the testing device known as a blunt rod penetrometer employed in testing samples of the rock shield.

In the drawings, **10** represents the outlines of a trench or ditch which has been prepared in terrain traversed by a gas or oil pipe line. The terrain may be swampy or dry; and it may be largely composed of dirt and rocks, or it may be composed principally of rocks. The manner of preparing the trench forms no part of this invention. The pipe **11**, shown in section consists of the usual lengths of steel pipe such as is employed in pipe lines, welded together at abutting sections and varying in diameters between twelve and thirty inches. The manner of fabricating the pipe line forms no part of this invention, and as shown in the drawing the trench has been made, the pipe line has been laid in the trench and the rocks and dirt previously excavated are to be back-filled into the trench to partially or entirely fill the trench and cover up the pipe line. Such back-filling operation is customarily effected by means of mechanically actuated bulldozers or other suitable filling and grading machines and rocks and dirt are literally showered or dumped upon the pipe line, developing impacts from the rocks upon the surface of the pipe and adding accumulating pressures to the pipe as the rocks and dirt are filled in, thus causing great abuse to the surface of the pipe or to the material encasing or shielding said pipe.

As shown in Figure 1, the shield **12** is placed only upon the exposed area of the pipe **11**, that is, the area most likely to be damaged in the back-filling process. The shield **12** will be described hereinafter but for the purposes of Figure 1 it is sufficient to state that the shield is manufactured in lengths of six to twelve feet and of widths of seventeen to thirty inches for pipe sizes four to eight, and in lengths of three feet and of widths of thirty-eight to fifty inches for pipe sizes ten to thirty-six. The shield is preferably placed upon the pipe as shown in Figure 1, and this is sufficient, but a shield may be completely wrapped around the pipe if that is deemed necessary. The shield is readily curved about the exposed surface of the pipe **11** and secured to the pipe in a manner hereinafter described.

The shield of this invention, as shown in section at A in Figure 2, includes a central asphaltic composition mastic layer **13** which is disposed between outer layers of felt or kraft paper **14** and **15**, and is made in sheets having the dimensional characteristics previously referred to. In place of the felt or kraft paper, glass-mat or asbestos paper or other materials of like nature may be employed, but kraft paper or felt are generally employed since they are usually the cheapest of the materials.

The asphalt composition mastic consists of an asphalt-sand ratio, as follows:

	Percent
Asphalt	15 to 40
Sand	60 to 85

The asphalt employed in the mastic has the following characteristics:

Melting point, ball and ring	100°–230° F.
Penetration at 77°±2° F	5–100

but it has been determined in tests that a typical physical characteristics analysis of the asphalt employed, approaching that of the most desirable, is as follows:

Melting point, ball and ring	175°–230° F.
Penetration at 77°±2° F.	5–35

The asphalt preferably is of the catalytically blown asphalt type, such as disclosed in the patent to Hoiberg, 2,450,756, but air blown and natural asphalt may be utilized.

The sand employed in the mastic must be at least 94%± silica; of 95% 30–80 mesh, with no particle size larger than 30 mesh and having a Krumbein number ranging from 0.3 to 0.7. The sand particles may be roughly ovoid, oblong, spheroid, rectangular or any shape ranging from square to round but having definite edges and being crysalline in nature. The Krumbein number is a technical notation made concerning the shapes of crystalline materials, and indicates the shape ranging from square to round, and numbered from 0.1 (square) to 1.0 (round).

The asphalt composition mastic differs from the prior art mastics including asphalt and fillers and fibers with or without roofing material scrap, in that it includes a sand the particle size and shape of which are important, and the asphalt in the predetermined percentages. This composition mastic develops the optimum resistance to pressure as well as to impact of falling rocks.

The shield, in the process of manufacture, may be coated with a continuous coat of asphalt having the above typical analysis, and this prevents the penetration or absorption of moisture or moisture vapor which, if not prevented, would accelerate the tendency of the unprotected surfaces of rag felt, asbestos felt, kraft paper and the like to shrink. This tendency to shrink is very marked; sometimes amounting to as much as fifty percent of the surface area; and is particularly noted when the surface area is subjected to above-ground weathering. Unless corrected, the shrinkage in surface areas of rock shields placed upon a coated pipe would normally have a very high stress effect upon the coating which is supposed to be protected. Thus, by avoiding the shrinking factor in the manner above noted, the original lineal dimensions of the shield are maintained, and this is a very important factor to be considered in protecting pipes and their coatings, during their life expectancy.

The rock shield is preferably formed by continuously moulding the layers **14** and **15** into contact with the composition mastic layer **13** when it is hot and in a semi-solid form. This permits the flow of the mastic composition into the adjacent surfaces of the layers **14** and **15** whereby the layers are united adhesively with the mastic composition layer. Hence the resulting sheet, after being coated with the asphalt as described above, is non-cracking, resistant to pressure and impacts, non-curling and non-shrinking.

The method of attaching the rock shield **12** consists in employing either a hot or cold application of the asphalt, described above, which may be applied to the pipe **11**, and is shown at **16** in Figure 2. The asphalt may be applied over the surface of the pipe to be covered by the shield, or, preferably, in spaced spots, so that the asphalt serves the sole purpose of holding the shield in place on the pipe until the ditch or trench has been covered or back-filled. This method of attaching the shield to the pipe eliminates the costly prior art practice of employing metal wires or straps.

In the course of development of the rock shield forming a part of this invention, a special testing equipment, shown in Figure 3, but one not invented by the applicant, was employed for checking blunt rod penetration and cold flow characteristics of samples of the shield forming a part of this invention. It has been termed, by those skilled in this art, a blunt rod penetrometer.

As shown at **20** and **21** two samples of the shield, as made in accordance with the above disclosure, are being tested. All tests in a well conducted laboratory are run, either in duplicate or in triplicate, in order to avoid any misinterpretation of results. A series of tests and several pieces of apparatus such as shown in Figure 3 are set up to show comparative penetration of the blunt rod over a period of time.

In Figure 3, the samples **20** and **21** are placed upon a part of the frame member **22** which is constructed in the manner shown. A pair of free moving ¼ inch rods are placed in a vertical position as shown, said rods contacting samples **20** and **21** as shown. The upper ends of the rods are provided with cups **24, 24** adapted to receive varying quantities of lead shot. Beneath each cup and spaced therefrom are washers **25, 25,** through which the rods **23, 23** extend but are secured to the washers. Each washer is spaced the same distance downwardly from its respective cup. Arranged parallel to each rod **23, 23,** is a second ¼ inch rod **26** attached to the frame **22** and extending vertically beneath the washer **25.** Each rod **26** is of the same length and is spaced the same distance downwardly from each washer **25.** Hence, before the samples **20** and **21** are placed in the penetrometer, each set of parts **23, 24, 25,** and **26** has identical characteristics.

The blunt rods **23, 23,** are so constructed so as to move freely up and down in the frame member **22,** and each rod is ¼ inch in diameter and approximately 10 inches long. A total load on each rod is placed at the rate of ten pounds per square inch of bearing surface. Afer having placed the blunt rod on the material **20, 21,** a preliminary reading is taken with an inside caliper to the closest micron. Daily readings are taken and recorded, the test being carried out at a temperature of 77°± 2° F.

The purpose of the washers **25,** which are fixed to the blunt rods **23, 23,** is to furnish a surface upon which one leg of a caliper is placed in order to measure the distance which the rods drop over any specified period of time, due to the blunt rods having penetrated the samples **20,** and **21.** The purpose of the stationary vertical rods **26, 26** is to form a surface on which the other leg of the caliper is placed when taking a penetration measurement. The depth of the penetration of the rod is measured over a period of time and recorded for various materials, samples, or comparative materials.

It can thus be seen that a shield has been provided which has all of the desirable properties necessary for a rock shield, and the particular construction thereof eliminates the disadvantages of the prior art. In installation and use, the invention will very markedly decrease both the cost of material required for pipe protection and the cost of labor of installation in that the strapping and fastening devices needed to handle the shield in the normal conventional ways have been avoided.

It should be pointed out that the penetration characteristics given previously herein and those recited in the claims for the various asphalts were determined with standard tests and equipment and not with the test apparatus of Fig. 3. Such apparatus of Fig. 3 is used to test the final laminated product or shield A (Fig. 2) to determine its relative resistance to impact by rocks and the like as compared to other materials which have been proposed and/or used for rock shields.

What is claimed is:

1. An asphaltic composite monolithic shield for use in covering pipe lines, comprising an intermediate asphalt-sand composition layer having an upper and a lower surface, a layer of fibrous reinforcing material on each of said surfaces of said asphalt-sand composition layer, and bonded thereto to form a composite monolithic sheet, said sheet having a thin outer coat of waterproof asphalt thereon rendering said reinforcing material impervious to moisture for preventing the shrinking thereof, and said

asphalt-sand composition layer consisting essentially of asphalt in the amount of 15% to 40% and sand in the amount of 60% to 85%, the asphalt in said composition layer having a melting point (ball and ring) in the range of 175° F.–230° F. and a penetration at 77° F. of from 5–35, whereby said shield is substantially non-curling, non-cracking, non-shrinking and resistant to impacts.

2. An asphaltic product as set forth in claim 1, wherein the asphalt in said waterproof asphalt coating has a melting point (ball and ring) in the range of 100° F.–230° F. and a penetration at 77° F. of from 5–35.

3. An asphaltic product as set forth in claim 1, wherein the sand in said asphalt-sand composition layer is at least 94% silica of 95% 30–80 mesh and has a Krumbein number of 0.3 to 0.7.

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