My invention relates to corrugated culverts in which a paving or lining is formed which resists abrasive and corrosive action in the same.

There are two general types of so called paved corrugated metal culverts, which have gone largely into general commercial use. One of these is built according to the Cushman Patent No. 1,652,784, dated Dec. 13, 1927, and Patent No. 1,735,732, dated November 12, 1928, the other is built in accordance with the Freeze Patent No. 1,984,125, dated Dec. 11, 1934, and No. 2,006,888, dated July 2, 1935.

A difficulty attendant upon either the Cushman practice or the Freeze practice, is the use of an asphalt which will bond with the metal pipe, resist abrasion, and at all temperatures normally encountered, remain in close adherent contact with the metal of the pipe.

It has been proposed by Coffman in Patent No. 2,162,932, to secure an asbestos layer to the metal sheet by coating the sheet with hot metal such as tin or zinc, and using this hot metal to bond the asbestos layer or felted body to the sheet. I have found that if a sheet is so coated with an asbestos felt pad, and this pad is saturated with asphalt, that a bond is formed upon which the regular paving of either the Cushman type or the Freeze type may be applied with greater permanence. I have found that the asbestos felt covered sheet saturated with suitable asphalt, can be corrugated in the usual manner, and formed into culvert pipe in the usual manner, after which the paving either of the Cushman type or Freeze type is applied.

An asbestos felt which is provided with some organic fibrous material to make it stronger, and has binders of organic origin such as starch or the like, operates with particular success in my practice, because the organic fiber and binder will be driven off during the bonding operation by the temperature of the hot coating metal, thus making a porous sheet which will readily take up the saturating asphalt.

I accomplish my objects by that certain structure and practice of which examples will be given in the following specification, the invention inherent therein being set forth in the appended claims to which reference is made.

In the drawings:

1. Fig. 1 shows a sheet which has been coated with asphalt felt by bonding with hot metal coating applied to the sheet.

2. Fig. 2 is a view of the said sheet in section showing the bonded, asphalt saturated pad in place.

3. Fig. 3 is a like view showing the same sheet connected.

4. Fig. 4 is a finished culvert showing one type of paving.

5. Fig. 5 is another culvert showing a different type of paving.

I am aware that it has been proposed to apply a felt sheet which has been saturated with asphalt to a sheet of metal to which the sheet is bonded with asphalt. I am also aware that the Coffman method of bonding an asbestos pad to a metal sheet contemplates also the possibility of an additional coating or saturation of the asbestos covering after it has been applied.

My invention is related to applying these fundamental ideas to the structure of culverts of corrugated metal, together with the necessary additions and modifications required to do so. The final structure which I provide possesses valuable qualities not apparent from the knowledge which I have above imputed to the prior art, and will be developed as this description proceeds.

Referring to the drawings, the first sheet of metal 1, is passed through a galvanizing bath of usual zinc or spelter. The temperature of the spelter will be at 750 to 850 degrees Fahr. The coated sheet is fed from the galvanizing pot while the zinc is still highly molten through a set of rolls. Dependent upon whether one or both sides of the sheet are to be treated, webs of asbestos paper (preferably weighing five or six pounds to the square foot) are run under and over the sheet of coated metal. It is particularly important to have the asbestos paper dry when this operation takes place. The action of the rolls is to squeeze the paper against the sheet and bring about the condition that the spelter as it hardens bonds in with the fibres of the asbestos paper, which are imbedded in the spelter.

Due to the heat of the spelter, the asbestos paper as it emerges from the rolls is altered by the heat, with the goat hair or other organic fibre, and the binder of starch or the like, burned away, leaving the sheet more porous than it would be otherwise.

A cooling wheel is employed, into which the sheets are fed from the bonding rolls, and after passing over the cooling wheel the sheets are roller leveled, and the edges trimmed so as to be free of overhanging fibrous material.

The sheet is now in the form illustrated in Fig. 1, with the metal body 1, the spelter coating 2, and the fibrous pad 3 all three bonded together by the hardened spelter.

The next stage is to saturate the asbestos pad. To do this the covered sheet is heated up to preferably around 350 degrees Fahr. and passed between rolls supplied with saturating asphalt, which is kept at around 450 degrees Fahr. The sheet is then passed between squeeze rolls, which squeeze out any excess saturant, whereupon the sheets pass to a second cooling wheel. This re-
suits in the sheet shown in Fig. 2, wherein the saturated pad is indicated at 4. Should the covering be located on both sides of the sheet, it will be passed through a saturating bath of the asphalt rather than the roll type of applicator, whereupon the squeeze roll operation will follow as in the first case. It is also feasible to spray the saturating asphalt on the sheets.

When the sheets have cooled down, say so that the hand can be placed upon them, which may be around 130 degrees Fahr. They pass through corrugating rolls in the usual manner for zinc coated sheets, and are ready for shipment to the plant where the culvert is made, or for making into culverts immediately, as the case may be.

Although nested in shipment, as will be necessary for economy, the corrugated sheets will not adhere to each other because there is a minimum of coating on the surface of the saturated asphalt paper. I show in Fig. 3 the corrugated sheet, the corrugations being indicated at 5.

The saturating asphalt is best one which has a ball and ring melt point of between 125 and 145 degrees Fahr., and a penetration at 25 degrees centigrade, 100 grams five seconds, of 30 to 50.

The culvert sections 6 are formed in the usual manner with the corrugated sheets after which they are dipped in coating asphalt. This asphalt preferably is one having a ball and ring melt point of 200 degrees to 210 degrees Fahr., and penetration at 32 degrees Fahr. 100 grams five seconds of around 35, and at 115 degrees Fahr., of around 75. It will be noted that this coating asphalt has a much higher melt point than the saturating asphalt, but it will bond with the saturating asphalt. I apply the coating at around 375 degrees Fahr.

After coating and while the coating is hot and plastic, I insert the premolded asphalt paving pads 7, which as noted in the Freeze patent here-tofore identified, will have their faces as applied to the corrugated culvert section, similarly corrugated which facilitates bonding of the pads in place. As is usually practiced, the pads are forced home into the culvert sections by rolling them down firmly. The coating asphalt adhesively secures them in place.

The culvert section or corrugated pipe is then given another dip in the coating asphalt and permitted to drain as in the first instance.

It can be seen that the asphalt in the pad and as a coating on the asbestos paper, and as permeating the paper, forms a continuous bonding medium for holding the several layers bonded together, and that the metal which bonds the asbestos paper to the corrugated sheet completes a strong and effective bonding of all of the super-imposed layers to the metal.

Instead of using pads a series of dips and drains of the corrugated pipe, permitting the coating to harden somewhat in between dips will give a paving in the culvert which will still necessarily have some corrugations in it. I have not illustrated this form, but its structure will readily be understood without illustration.

Also instead of dipping and draining the culvert section can be laid on its side and the coating asphalt not caused to form a pool in the section a little when it hardens will form a level floor. After one pool has hardened another may be applied, etc., by changing the orientation of the pipe and flowing in a fresh body of the coating asphalt. Or the pipe section or joined sections can be dipped into coating asphalt and not drained but laid on their sides so that a pool or pools are formed.

The culvert so formed is illustrated in Fig. 4, in which there are shown two level floors formed in the last noted manner, this being the practice in the Cushman type of paving.

By explaining several modes or variants in procedure, I do not wish to be understood as representing that these are the only practical ones, as several other practices may be employed to produce my final product in its several forms.

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

1. A culvert comprising a corrugated body formed of a metal sheet with a coating of spelter bonded therewith, an asbestos web bonded to the sheet by means of said spelter, said asbestos web saturated with asphalt, and a coating of asphalt bonded with the asphalt saturant of said web.

2. A culvert comprising a corrugated body formed of a metal sheet with a coating of spelter bonded therewith, an asbestos web bonded to the sheet by means of said spelter, said asbestos web saturated with asphalt, a coating of asphalt bonded with the asphalt saturant of said web and an additional coating in the form of a pad of asphalt material which prior to application was formed with corrugations corresponding with the corrugations in the corrugated body.

3. A culvert comprising a corrugated body formed of a metal sheet with a coating of spelter bonded therewith, an asbestos web bonded to the sheet by means of said spelter, said asbestos web saturated with asphalt, and a coating of asphalt bonded with the asphalt saturant of said web, said coating of asphalt being so formed as to form at least one level floor portion for the culvert wherein the corrugations thereof are filled.

4. A culvert comprising a corrugated body formed of a metal sheet with a coating of spelter bonded therewith, an asbestos web bonded to the sheet by means of said spelter, said asbestos web saturated with asphalt, a coating of asphalt bonded with the asphalt saturant of said web and an additional coating in the form of a pad of asphalt material which prior to application was formed with corrugations corresponding with the corrugations in the corrugated body, said pad being bonded to the coating on the asbestos web.

5. A culvert comprising a corrugated body formed of a metal sheet with a coating of spelter bonded therewith, an asbestos web bonded to the sheet by means of said spelter, said asbestos web saturated with asphalt, a coating of asphalt bonded with the asphalt saturant of said web and an additional coating in the form of a pad of asphalt material which prior to application was formed with corrugations corresponding with the corrugations in the corrugated body, said pad being bonded to the coating on the asbestos web, and a final coating of asphalt upon the pad.

6. A culvert comprising a corrugated body formed of a metal sheet with a coating of spelter bonded therewith, an asbestos web bonded to the sheet by means of said spelter, said asbestos web saturated with asphalt, a coating of asphalt bonded with the asphalt saturant of said web, said saturant asphalt being of lower melt point than the coating asphalt.

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