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W. H. FLOOD

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PAVEMENT AND PROCESS OF LAYING

Original Filed March 22, 1926

Fig. 1

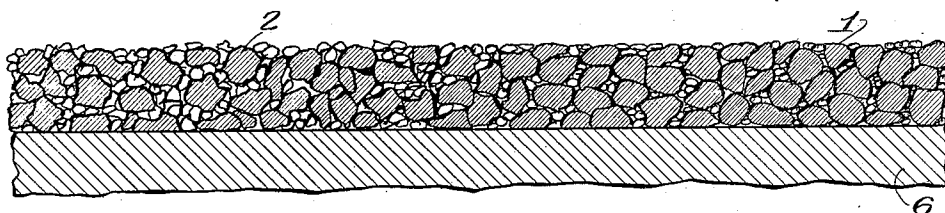


Fig. 3

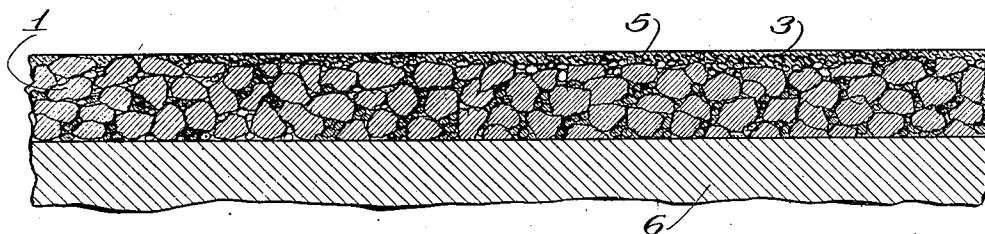


Fig. 2

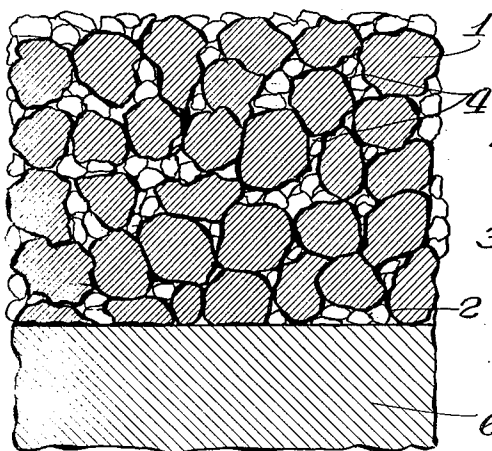
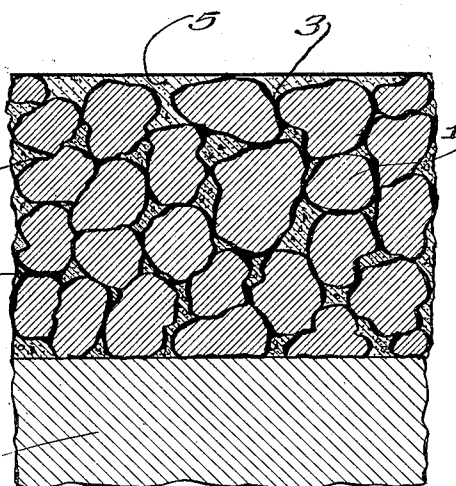


Fig. 4



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UNITED STATES PATENT OFFICE

WALTER H. FLOOD, OF CHICAGO, ILLINOIS

PAVEMENT AND PROCESS OF LAYING

Continuation of application Serial No. 96,366, filed March 22, 1926. This application filed June 17, 1929.
Serial No. 371,380.

My invention relates to pavement of the same type disclosed in my United States Letters Patent No. 1,717,445, dated June 18, 1929, and to a process of laying the same while cold.

5 The present invention constitutes a continuation of the subject matter disclosed in my above noted patent.

The class of pavement to which my present invention applies as disclosed and claimed in
10 my copending application, comprises a course of stones individually coated with bituminous material of sufficient thickness to prevent adherence of cement to the stones, and a hydraulic cement grouting for filling substantially all the voids in and the interstices between the stones of the course thus forming a skeleton framework for holding the stones in position and to prevent their displacement, the coating of bituminous material serving
15 to bind the stones to the grouting as well as a partition medium to separate the stones from the cement so as to allow for expansion and contraction stresses and to thus minimize cracking of the pavement.

25 The ordinary asphalt pavement has several defects, the most serious of which is its tendency to displacement resulting in waves and ruts. In order to overcome this fault, it is necessary that the percentage of asphalt be maintained within close limits and that the grading of the mineral aggregate be carefully controlled. In the less expensive form of asphalt paving, known as asphaltic concrete containing from 20 to 70% of stone, the remainder being sand and asphalt, the displacement of the pavement is frequently due to the mortar of sand and asphalt preventing the stone particles from obtaining a firm bearing on each other. Greater stability is secured
30 when the stone particles are keyed together on themselves, the mortar functioning only to fill the interstices or voids. It is, however, impossible to secure this condition by ordinary methods where all the ingredients are mixed
35 together.

The advantages of an asphalt pavement are its plasticity, pliability, non-rigidity, resilience and ease of repair. The defects of cement concrete type of pavement are its rigidity and
40 tendency to crack and disintegrate from

stresses imparted by the sub-grade and temperature changes. The class of pavement to which my invention relates combines the advantages of asphalt and concrete pavement and at the same time overcomes their faults. 55

Now, in the laying of the so-called "hot mix" pavement, it is necessary to use an expensive type of asphalt plant which frequently costs as high as \$20,000 or more and requires a number of attendants to operate it. Then
60 too, the cost of moving one of these plants from one town to another involves not only the freight charges, but the dismantling and setting up and the rental of switch track facilities, amounting to usually around \$2,000 or \$3,000 for each time the plant is moved. Hence it will be readily evident that the cost of laying hot mix pavement is frequently prohibitive in the case of small towns and the like desiring to lay a small stretch of pavement. 65

An object of my invention is to provide a cold laid pavement and process of laying the same which does not necessitate the use of an expensive asphalt plant but which requires only the use of a small inexpensive concrete
70 mixer costing from \$2,000 to \$3,000. 75

Another object of my invention is to provide a pavement which permits of the use of a relatively soft or liquid bituminous material whereby the pavement can be laid cold. The
80 laying of the mineral aggregate while cold is, of course, advantageous even if this material were originally mixed in a large plant by the hot process in view of the fact that it could be subsequently shipped from the plant
85 and hence would not require the transporting of the plant to the place where the pavement is to be laid.

In accordance with the general features of my invention, I therefore provide a pavement
90 of the same type as that disclosed in my copending application and process of laying the same which utilizes a relatively soft or liquid bituminous material in place of the ordinary hot asphaltic mixture used in the pavement
95 of my copending application whereby the pavement can be laid cold.

Other objects and advantages of my invention will more fully appear from the following detailed description taken in connection 100

with the accompanying drawing which illustrates an embodiment thereof and in which:

Figure 1 is a sectional view of a pavement embodying the principles of this invention in the process of construction;

Figure 2 is an enlarged detail sectional view of the same;

Figure 3 is a sectional view of a pavement in complete form; and

Figure 4 is an enlarged detail sectional view of the same.

As shown on the drawings:

My invention in general consists in first laying to the desired depth a layer of crushed stone, indicated by the reference numeral 1, to which has preferably been previously applied a coating 2 of asphalt or similar bituminous compound over the individual particles of stone. The crushed stone 1 should be relatively coarse and preferably be previously graded from about $1\frac{1}{2}$ inches in size down to $\frac{1}{4}$ or $\frac{1}{8}$ inch, but with sufficient of the larger sizes to leave the finished mixture after rolling on the road bed 6 in an open condition. The mixture may, if desired, contain some sand or fine material, but not enough to prevent the pieces of stone from bearing on each other firmly. The coating of asphalt 2 is only sufficient to thoroughly cover the individual stones without filling up the voids 4 between the stones.

There are on the market numerous brands of so-called "cut-back" asphalts, also sometimes known as "cold patch" asphalts. These products consist of either a solid asphalt brought into liquid form with naphtha which evaporates thereafter and leaves the asphalt in almost the original consistency, or they may be known as emulsified asphalts which consist of solid asphalt emulsified to a liquid form with water by a special process. Upon evaporation of the water the asphalt remains in more or less solid form.

My present invention involves the idea of using one of the above noted products or even a heavy asphaltic oil as the bituminous covering for the stone or gravel. This is advantageous since such a mixture could be mixed in a concrete mixer instead of requiring the expensive type of asphalt plant which is necessary when hot mix pavements are laid. Another advantage of this composition resides in the fact that in the laying of the material cold even if it were originally mixed in a large plant by the hot process still it could be shipped from the plant and would not require transporting the plant to the place where the pavement is to be laid.

After spreading the asphalt stone mixture on the road bed and rolling it in the customary way, a grout 3 of hydraulic cement and water, with or without sand, is spread over the asphalt course and forced into it by means of squeegees, rollers or other suitable means so that all or nearly all of the interstices 4

in the asphalt mixture are filled. The excess is then removed to form a smooth surface 5 and the cement mixture allowed to harden in the usual way. After hardening, the pavement may be opened to traffic, or if desired, a thin coating of asphalt cement may be spread, followed by a coat of sand or stone chips which are then rolled in.

The grout of hydraulic cement may be made of any desired consistency, depending upon the conditions to be met. It will be noted that the function of this grout is to produce a sort of artificial stone in the voids 4 between the particles of asphalt coated stone 1 and is not used as a cementing agent to hold the stone together as in the ordinary concrete pavement. The asphalt coating 2 on the stone prevents any adhesion of the grout 3 to the stone. The grout forms a sort of frame work or skeleton to firmly hold the stone in position and prevent displacement but allows a slight movement of the stone from expansion and contraction stresses due to temperature and other causes. It, therefore, does not result in a rigid pavement but is made up of individual particles cemented together by the asphalt and made dense and resistant to the entrance of water by means of the cement grout which forms artificial stone particles of the exact size of the voids in the asphalt mixture. In this manner a pavement of great stability is secured which also possesses resiliency and plasticity and is non-rigid.

It is not new to make a cement concrete pavement by rolling the stone on the street and pouring a cement grout into and over the stone. This, however, cements all particles together into a rigid slab producing a pavement very similar to the ordinary concrete pavement. The advantage claimed for this method over the ordinary manner of mixing all the materials together in a concrete mixer is that it is claimed to produce a denser and stronger slab. The function of the cement grout in this type of construction is, as pointed out, entirely different from that as employed in my invention.

As mentioned previously, an asphalt pavement must be closely controlled as to its asphalt content; a slight excess results in an unstable mixture with consequent displacement under traffic while a slight deficiency causes a tendency to cracking and disintegration due to there not being sufficient asphalt to cement the mineral aggregate firmly together. If it were not for the tendency to displacement, which is the most common and serious fault of an asphalt pavement, a large amount of asphalt cement in the mixture would be beneficial as it increases the pliability and resiliency of the pavement and its resistance to the action of water.

From the foregoing it will be evident that the principal difference between my present

pavement and process of laying the same and that disclosed in my aforesaid patent is that I here use a so-called soft asphaltic or bituminous covering for the stones or gravel so that the pavement may be laid cold. I can use not only a soft asphaltic cement or tar for covering the stones or gravel but also liquid materials such as road oils, tars and "cut-back" asphalts and tars, which are more or less solid bitumens dissolved in naphtha to make them fluid, the naphtha afterward evaporating and leaving the heavier residue.

In the ordinary type of asphalt paving the stone and sand, termed the mineral aggregate, must be of a specified character, as the size of particles must be controlled within fairly narrow limits, thus necessitating the shipping of material over relatively long distances since it is frequently impossible to obtain the required character of sand for the pavement, especially in the locality of the pavement being laid. Then too, these pavements also require a bituminous cement sufficiently stiff to prevent displacement of the particles of mineral aggregate as the bituminous cement is the only means of support of these mineral particles. In my invention the cement grout supports the mineral aggregate and not only can a soft bituminous cement be used but there is no necessity for careful or close grading of the mineral aggregate thereby permitting any sufficiently hard stone or gravel of only approximately desirable sizes to be used. The usual reason for requiring a carefully graded sand in sheet asphalt construction is to produce the necessary stability in order that the various size grains, starting with the larger ones, may be supported by the proper quantity of the next smaller size, filling the voids between them, and these in turn being filled by the next smaller size and so on to a fine powder. In sheet asphalt construction this fine powder is supplied by the addition of pulverized limestone dust, silica dust or any other very finely ground mineral dust.

From the foregoing it will be evident that in my pavement the supporting action of the cement grout permits of the use of a wide range of aggregate material which possesses sufficient stability for use in the ordinary bituminous pavement. For example, gravel which is the only commercially available material in many localities may be so rounded and smooth that it would readily become displaced in the usual type of pavement. However, in my pavement the cement grouting prevents any possibility of the movement of the gravel particles thus allowing the use of a cheap and widely available ingredient which would be unsatisfactory in the usual or ordinary bituminous pavement.

The essential elements of the invention are an asphalt coated stone mixture in which the stone is large enough to possess great stability and the subsequent filling of the voids in

the asphalt mixture with artificial stone made by the hydraulic cement grout. As pointed out, it is necessary that the stone particles of asphalt mixture are thoroughly keyed together and have a firm bearing on each other. This is a recognized practice in road construction, as in the building of water bound macadam pavements coarse stone is thoroughly rolled until a good keying is secured, after which the voids are filled with fine stone screenings, water being used to secure thorough distribution of the screenings. In the ordinary type of asphaltic concrete pavement, sand or fine aggregate must be mixed with the asphalt and stone in order to make the pavement close sufficiently to prevent water and dirt from entering and also to prevent movement of the stone particles. As this sand is mixed with the stone and asphalt at the asphalt plant, it is impossible to retain the sand or finer particles entirely in voids but much of it gets between the stone particles and prevents a firm bearing and keying together of the stone. In this invention the grout finds its way into the open voids and cannot prevent the stones from bearing on each other as they are already in proper position. It is a well known fact that the larger stone particles possess greater stability in the pavement than the small size. However, in an asphaltic concrete, the size of the stone is limited on account of the large voids which the larger stone has so that the larger the particles of stone used the less amount of stone can be used as it requires more fine material to fill the voids. With this invention, stone of any size may be used, voids being entirely filled by the cement grout.

I am aware that many changes may be made, and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I therefore do not purpose limiting the patent granted hereon, otherwise than necessitated by the prior art.

I claim as my invention:

1. A cold laid pavement comprising a course of stones individually coated with soft or liquified bituminous material of sufficient thickness to prevent adherence of cement to the stones, and a hydraulic cement grouting for filling substantially all the voids in and the interstices between the stones of said course thus forming a skeleton framework for holding the stones in position and to prevent their displacement, said coating of bituminous material serving to bind the stones to the grouting as well as a partition medium to separate the stones from the cement so as to allow for expansion and compression stresses and to thus minimize cracking of the pavement.

2. The process of laying a cold pavement which consists in grading a given batch of stones, covering each of said stones with a

soft or liquefied bituminous material of sufficient thickness to prevent adherence of cement to the stones and to allow for expansion and compression stresses to which the pavement may be subjected, laying a course of said stones, compacting said course so that the stones are keyed to each other to form a firm foundation, spreading over said course and forcing thereinto a hydraulic cement grouting to substantially fill all the interstices and voids between the compact stones thus forming a skeleton framework for holding the stones in position and to prevent their displacement, and thereafter smoothing off an excess of said cement grouting from the top of said stones.

3. A cold laid pavement comprising a course of stones coated with relatively soft bituminous material capable of being applied to the stones while in a cold state and a grouting for filling substantially all the voids in and the interstices between the stones of said course.

In testimony whereof I have hereunto subscribed my name at Chicago, Cook County, Illinois.

WALTER H. FLOOD.

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