

No. 727,505.

PATENTED MAY 5, 1903.

F. J. WARREN.
PAVEMENT.

APPLICATION FILED MAY 16, 1901.

NO MODEL.



Fig. 1.

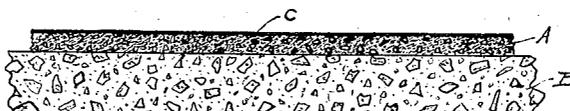


Fig. 2.



Fig. 3.

WITNESSES:

J. M. Dolan
Saul Sippert

INVENTOR

Frederick J. Warren

BY

Charles F. Johnson
ATTORNEYS

UNITED STATES PATENT OFFICE.

FREDERICK JOHN WARREN, OF NEWTON, MASSACHUSETTS.

PAVEMENT.

SPECIFICATION forming part of Letters Patent No. 727,505, dated May 5, 1903.

Application filed May 16, 1901. Serial No. 60,450. (No specimens.)

To all whom it may concern:

Be it known that I, FREDERICK JOHN WARREN, a citizen of the United States, residing at Newton, in the county of Middlesex and Commonwealth of Massachusetts, have invented a new and useful Improvement in Pavements, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

The invention relates to an improvement in the class of pavements which comprise a base of mineral matter and a plastic uniting medium consisting of a natural or artificial asphalt or coal-tar composition, which are intimately associated together and used as the main upper or top surfacing of the road-bed.

The invention is based upon my discovery that to insure the best conditions of construction, wear, and life in such pavements the portion of the pavement to which my invention relates must be made as dense, as free from voids as possible, and also stable and non-labile to displacement, and upon my further discovery that what has ordinarily been supposed to be the best provision for eliminating voids and establishing stability has, as a matter of fact, been almost the poorest provision for accomplishing these purposes. The provision usually accepted as the best is that in which the mineral matter used as a basis of the pavement and united by the plastic asphalt vehicle shall be in the shape of a sand or fine gravel. This, however, is an error, as I have discovered by experiment that there is a smaller percentage of voids in a pavement which contains mineral components which are of relatively large size. The method has been in the construction of this class of pavements to exclude from its composition all pieces of stone or sand larger than one-tenth of an inch in diameter; but by so doing the smallest percentage of voids that it has been possible to produce has been twenty-one per cent. of the aggregate, while by the use of the larger-sized grains or pieces—say up to those which will pass through a two-inch ring—and employing with these larger grains proper quantities of the smaller sizes down to an impalpable powder it is possible to reduce the voids of the mineral base below ten per cent. of its bulk, and such a

mixture when assembled and compacted together will form a dense, solid, homogeneous, compact body with the smallest percentage of voids and possessing the highest degree of stability, and one in which the largest and smallest pieces are associated with each other indiscriminately throughout the structure, and one which, because of the sizes of the pieces and their arrangement with respect to each other, offers the smallest areas of surfaces for the attachment of the plastic composition to them, so that not only is a superior binding effect or union obtained by the plastic composition, but a smaller quantity of it is necessary for the purpose of obtaining the superior result or product. I prefer to use from one to three per cent. of impalpable powder, from ten to thirty per cent. of material between impalpable powder and one-fourth of an inch in size, and from fifty to eighty per cent. of material larger than one-fourth of an inch in size. I have found that these ingredients when associated together produce a mass or body having less than twenty per cent. of voids. I prefer to use as the uniting or plastic composition one which comprises asphalt and an oil-flux heated to a moderate heat to provide the requisite fluidity; but I do not confine myself to any special form of artificial or natural asphalt. It will be understood that the mineral components are not arranged in the form of layers of the same size, but are mingled with each other from the upper to the lower surface of the pavement, and that the plastic composition permeates the entire mass, uniting the various sized particles thereof, filling the voids, and forming the surfaces.

It will be understood that this pavement is used as the upper or wearing section of a road-bed and that it may be covered, if desired, with a relatively thin surfacing of clear asphalt-cement or an asphalt or bituminous composition of any desired nature. In some instances there may be rolled into this thin surfacing while it is yet soft sufficient sand, gravel, or fine stone to prevent its displacement by traffic.

I will now describe the invention in connection with the drawings, wherein—

Figure 1 is a view in horizontal section of enough of a pavement to illustrate in a con-

ventional way the features of my invention, while Figs. 2 and 3 are corresponding views representing the addition of a surfacing to the structure of Fig. 1.

5 In the drawings, A represents the portion of the road-bed to which my invention relates and which may be called the "wearing-section" of the road-bed and is the portion which covers and is supported by the mac-
10 adam or other foundation B. In the wearing-section are represented some of the larger mineral pieces, some pieces of intermediate size, and some of the smaller pieces and also the plastic composition which unites them to-
15 gether, and C represents the surfacing to which I have referred. It is represented as somewhat thicker in Fig. 3 than in Fig. 2. It will be understood, however, that the draw-
20 ings are simply illustrative and that it is not possible to represent the variations in the sizes of the mineral pieces, atoms, and powder which are employed in producing my im-
proved result.

In laying the wearing-surface the pieces,
25 particles, and atoms of the base are intimately associated with the plastic asphalt composition, which is then spread uniformly upon the prepared foundation and which in setting becomes very dense, solid, stable,
30 and freer from voids than any pavement of which I have knowledge. This density of the structure, stability, and its relative freedom from voids very much improve the wearing properties of the pavement, its resistance to
35 the action of water, and on account of its dense structure prevents the volatilization or oxidation of the essential oils in the cementing medium, increases its life, and while produc-
40 ing these improvements it also enables the wearing-surface to be produced at a smaller cost because a smaller quantity of plastic asphalt material is required than where the percentage of voids is larger.

A pavement or wearing-section of a pave-
45 ment having the features of this invention possesses various advantages, among which are the following: First, the percentage of mineral employed is increased and the per-
50 centage of plastic uniting medium decreased as compared with analogous pavements as now laid; second, the wearing properties of the pavement are increased and improved, and this is due to the employment of a larger proportion of mineral to the proportion of the
55 uniting medium and also to the fact that the mineral base is of such a structure, owing to the employment of a considerable percentage of relatively larger pieces, larger than are now used, that a very rigid and stable effect is ob-
60 tained and one which reduces strain and wear upon the uniting medium, more of the wear being borne by the mineral base and less by the uniting medium than is common; third, the interstices or voids formed by such min-
65 eral components are also of a different character, in that they are larger and fewer, and therefore the asphalt or bituminous uniting

medium contained in them forms a cellular structure, which is stronger and adheres better to the surfaces of the mineral components than where the voids or interstices are more numerous and of less size. 70

Because of the inherent stability obtained by me by the careful selection and proportioning of several grades of mineral ingredi- 75 ents I am enabled to use an asphalt or bituminous uniting medium of a softer nature and at a lower temperature than could otherwise be used. This is because in my case the wear and strain fall upon the mineral 80 ingredients and not upon the binder, which latter may be as soft as desirable. In this application, however, I do not claim, broadly, a binder or cement of this character. I have reserved the same to be claimed in my co- 8: pending application Serial No. 60,819.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States—

1. A street-pavement mixture composed of 90 mineral ingredients ranging in grades from three inches down to an impalpable powder, from fifty to eighty per cent. of such mineral ingredients lying between one-fourth inch and three inches in diameter, in combination 95 with a bituminous binder.

2. A street-pavement mixture composed of mineral ingredients of several grades from an impalpable powder to three inches in diameter, over fifty per cent. of such ingredi- 100 ents being larger than one-fourth inch in diameter, and a bituminous binder.

3. A street-pavement mixture composed of mineral or wearing ingredients, of which ap- 105 proximately fifty to eighty per cent. are between one-fourth inch to three inches in diameter, approximately ten to forty-nine per cent. between an impalpable powder and one-fourth inch in diameter, and approximately one to three per cent. of an impalpable pow- 110 der, in combination with a binder.

4. A street-pavement mixture composed of mineral or wearing ingredients, of which ap- 115 proximately fifty to eighty per cent. lies between one-fourth inch and three inches in diameter, approximately ten to forty-nine per cent. between an impalpable powder and one-fourth inch in diameter, and approximately one to three per cent. an impalpable powder, in combination with a bituminous binder, of 120 which the soft, oily constituent is sufficiently great to render the binder itself too flexible to maintain the structure rigid.

5. In a street-pavement, a bituminous mineral structure, the mineral ingredients of 125 which are mixed and of several grades, so graded as to give the structure an inherent stability.

6. A bituminous street-pavement structure containing mixed mineral ingredients of such 130 grades as to give the structure an inherent stability.

7. A bituminous street-pavement mixture comprising a binder in combination with a

mineral structure of inherent stability composed of wearing material of several grades uniformly mixed.

5 8. A street-paving mixture comprising a bituminous binder in combination with a mineral structure of inherent stability.

9. A street-pavement wearing-section composed of a mineral structure of inherent stability formed of several grades of material so
10 proportioned as to have a per cent. of voids less than twenty-one per cent. of the whole, in combination with a comparatively soft bituminous binder filling said voids and rendering the whole permanent in nature and
15 elastic and waterproof in character.

10. A mixture for street-paving purposes composed of a bituminous binder and a mixture of mineral ingredients of several grades having less than twenty-one per cent. of voids,
20 the binder being sufficient in quantity to fill the voids.

11. A street-paving structure composed of a mixture of mineral or wearing ingredients, and a plastic binder, the space between the

mineral ingredients being less than twenty- 25 one per cent. of the whole, and the plastic binder occupying said space.

12. A mixture of mineral or wearing ingredients of several grades, the ingredients of the descending grades in size and quantity
30 being so proportioned to each other and to the voids existing in the larger grades as to fill the voids and impart to the structure an inherent stability, in combination with a bituminous cement or binder. 35

13. A mixture to be used as a pavement having an inherent stability composed of mineral or wearing ingredients of several grades, the grades being thoroughly mixed and there-
40 by uniformly distributed throughout the mass and being of sizes and quantities so proportioned that ingredients of the same grade are uniformly in contact with each other, and a bituminous cement or binder.

FREDERICK JOHN WARREN.

Witnesses:

F. F. RAYMOND, 2d,

J. M. DOLAN.