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PAVEMENT AND PROCESS OF MAKING

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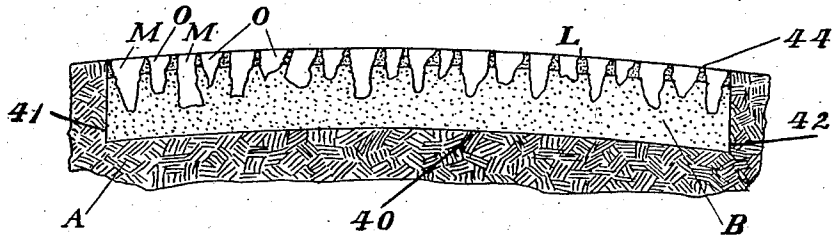


Fig. 1.

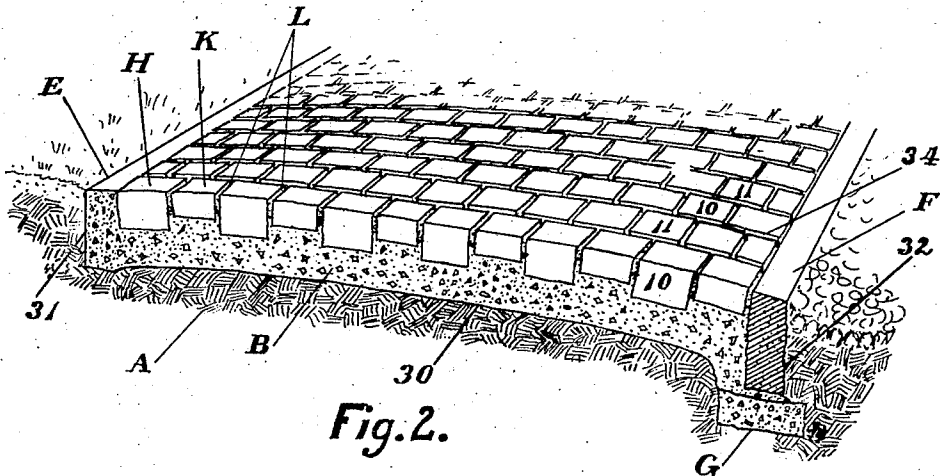


Fig. 2.

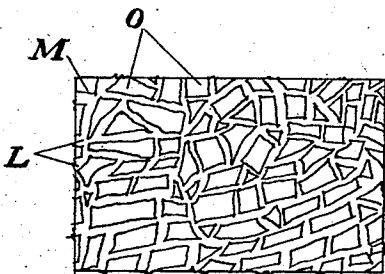


Fig. 3.

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PAVEMENT AND PROCESS OF MAKING.

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To all whom it may concern:

Be it known that I, HERBERT E. FLETCHER, a citizen of the United States, residing at Westford, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Pavements and Processes of Making, of which the following is a specification.

This invention relates to roads and the process of building them.

In the art of building what are considered permanent roads, it is necessary to so build that water shall not get in joints, cracks, or other places in the road proper where it can freeze and thus cause breakage, and so far as possible to keep it out from underneath where freezing and thawing would have a tendency to heave and break the road.

Roads of this character as now constructed include a subbase, generally of a natural soil, either excavated to the desired depth and shape, or filled, and the load carrying top.

It has been found highly desirable that the top should be continuous to keep out the water as above described, and that this top or pavement should have sufficient beam strength to span any soft spots in the subgrade which have arisen from any cause.

One great difficulty encountered has been the uneven expansion and contraction on account of heat and cold which goes on if the roadbed is reinforced with metal ties, and which also goes on in most structures which are not monolithic.

I am aware that roads have been built with a base of concrete or other similar monolithic material, and that on this has been placed a cushion of sand or cement, and that upon such cushion or upon the concrete itself, a surface layer of granite blocks, bricks, or other material has been placed.

In roads so constructed, however, the different layers expand or contract to different degrees and after a time cease to be bound together but allow a certain amount of slippage.

In such a case, if there are two layers each four inches thick, the combined strength is very much less than one monolithic structure eight inches thick.

It is the purpose of my invention to provide an homogeneous structure with a very durable top wearing surface and one in which the expansion and contraction will be reduced to a minimum, and what there is will do little, if any, harm.

Another purpose of my invention is to reduce the cost of such structures by constructing such a monolithic roadbed of such beam strength and consistency that less material can be used while still obtaining the desired strength.

Another object of my invention is to utilize the irregular blocks which are now waste in stone quarries, particularly, granite quarries, and blocks of various depths.

Suitable blocks for my pavement can be manufactured cheaply from what is now thrown away as useless except for crushing.

My invention further consists in an improved method of bonding stone blocks, which form the top part and which are of uneven depth, with the concrete bottom to provide a monolithic slab or a pavement of the required strength. This is accomplished by alternating deep and shallow stone blocks either alternate stone blocks in each course or in alternate courses or by any arrangement by which adjoining blocks vary in depth sufficiently to effectually bond the stone blocks with the concrete. By this method, stone blocks of either regular or irregular shape, but of various depths can be used. The results obtained are a reduction of labor and waste in the manufacture of stone blocks to be used in accordance with this method, and the increased strength of the pavement, one of the large items in the cost of stone blocks to be laid by usual methods being the expenditure of labor and waste of material necessary to manufacture stone blocks of uniform depth.

My invention further consists in an improved method of thoroughly uniting the several parts of the structure into a solid slab pavement by the sequence of operations as hereinafter described so that all parts of my pavement are bonded into a monolithic structure which will not be injured by expansion and contraction from heat and cold.

In the drawings,

Figure 1 is a cross section of a pavement of my construction and the surrounding earth.

Fig. 2 is a cross section of diagrammatic form and in part perspective showing some of the modifications which I may use.

Fig. 3 is a plan view of such a pavement as shown in Fig. 1.

In the drawings, A represents the natural earth which should be excavated to form a subgrade or foundation, the lines of which

are substantially parallel with what will be the finished surface of the street. The bottom of this is indicated at 30 and the sides at 31 and 32. Preferably, this subgrade or foundation should be thoroughly compacted by rolling or ramming.

On this subgrade or foundation, I spread a mixture B made of broken stone, gravel or other aggregate, preferably of relatively small size such as might pass through a one inch ring, mixed dry with Portland cement and sand. A good mixture is one part Portland cement, three parts sand and six parts broken stone by volume.

The aggregate may be damp when used, but should be free from excess water.

The mixture should be thoroughly blended in a mechanical mixer, preferably of the batch type, until it is of uniform color and composition. No water is to be added before or during the mixing.

After mixing, it is spread on the subgrade to the desired depth and kept dry until the stones or paving blocks have been properly set and rammed into place. This mixture B should be covered with the surfacing blocks very soon after it is laid before there is any chance for it to harden on account of moisture from the earth or air.

For my preferred type of pavement shown in Fig. 2, I use paving blocks H and K of substantially box shape and rectangular top faces, but of varying depths, the blocks H being deeper than the blocks K.

These are, preferably, laid in courses, such as 10, 11, with broken or overlapping joints, and a deep block H alternates with a shallow block K.

These are set with joints, preferably, from one-quarter inch to an inch in width.

In setting these blocks, they are fully bedded in the bottom of the dry mixture and the blocks are packed to a full compact bed in the mixture, which is then a dry cushion. Blocks should not be laid to any great extent in advance of the ramming.

After being laid, they are rammed to make a smooth or relatively smooth surface, and any which project unduly or are far below the general surface are removed and replaced by others.

These blocks must be so bedded that they will stand up in the bottom mixture preferably with sufficient strength so that workmen can pass over them with rammers.

Up to this stage of the process, the blocks must be kept perfectly clean, free from dirt, clay, and other objectionable materials, and the joints are to be kept open down to the point where the bottom mixture penetrates.

With substantially regular blocks such as shown in Fig. 2, the dry bottom B does not come up to any great extent into the joints 34, but where more irregular blocks are used,

as shown in Fig. 1, this bottom does come up to a higher point.

After the blocks have been laid and rammed, the whole surface is sprinkled with water from a spray nozzle. No more water should be applied than is necessary to allow the bottom dry mixture to set, and the water must be applied evenly.

Immediately after the spraying of the water, the openings 34 between the joints are filled with a wet grout L, preferably, composed of Portland cement and sand, or Portland cement, sand and small stones, mixed in a mechanical mixer or grouting machine, and of sufficient fluidity to allow it to run thoroughly into the joints and down clean to the bottom B.

This grout should be applied in such manner that the joint openings are completely filled and the excess grout appears on the surface of the blocks. It should be broomed or scraped into the joint openings if necessary so as to fill them. It may be necessary to repeat this grouting until the joint openings are permanently filled and the grout no longer settles therein. The surface of the pavement thus grouted should immediately be broomed to an even smooth surface.

After the grout has been applied and any excess removed, the pavement should be completely covered with a blanket, which may be of sand, which must be kept moist for perhaps a week. The pavement should be protected from all travel for perhaps ten days, during which time the moisture in the subgrade through capillary attraction works up into the bottom part B of the pavement, gradually causing it to take its permanent set.

In Figs. 1 and 3, I show a foundation in the soil A indicated by 40, 41, 42. The dry bottom mixture B is the same, but as the blocks M and O are of different depths and of more irregular shape, the dry bottom mixture B works up into the joints 44 to a higher point than where the blocks are rectangular.

The construction is the same as where rectangular blocks are used, and the joints 44 are filled with a suitable grout L as described above.

I may form a concrete curb such as E integral with the bottom B, or I may use a stone or any other type of curb, such as F, preferably, resting on a separate foundation G.

In any event, by my process, particularly, by the use of blocks of different depths, on account of the fact that the dry base works up in between the blocks, the whole thing is bound together securely, and there is no layer nor weak spot where it is likely to give way.

In the construction shown in Fig. 1, if granite blocks M, O are used, as the granite is stronger than the concrete the fact that it is narrow at the bottom and wider at the top gives a wide or thick section of concrete and a narrow section of granite which adds to the strength.

As there is no separate layer or base of a material even slightly different from the wearing or load carrying surface, expansion and contraction by heat and cold have no effect on my structure as it is a monolithic and thoroughly bonded slab. It expands and contracts so that there is no tendency to crack.

Instead of using a preferably dry mix for my base B, I may use a damp mix. I find, however, that if a wet mix of the usual concrete type is used, it is impossible to level the facing blocks because when one is rammed down, another jumps up.

I claim:

1. A monolithic pavement, the bottom of which is formed of aggregate, sand and hydraulic cement and water, and the top of which is formed of stone blocks having substantially smooth top surfaces and which extend into the bottom to depths varying substantially whereby the top and bottom are bonded together into a monolithic slab, the spaces between the blocks up to their top faces being filled with a grout of sand, cement and water.

2. A monolithic pavement the bottom of which is formed of aggregate, sand and hydraulic cement and water, and the top of which is formed of alternately deep and shallow stone blocks which extend into the bottom to various depths whereby the top and bottom are bonded together into a monolithic slab, the spaces between the blocks up to their top faces being filled.

3. A monolithic pavement, the bottom of which is formed of aggregate, sand, hydraulic cement and water, and the top of which is formed of stone blocks which extend into the bottom to depths varying substantially whereby the top and bottom are bonded together into a monolithic slab, the spaces between the blocks up to their top faces being filled.

4. The process of making monolithic pavements, which consists of depositing on a foundation of compact earth, a thoroughly mixed dry concrete composed of aggregate, sand and hydraulic cement, then imbedding therein paving blocks of various depths so that the dry concrete will fill the spaces beneath the shallow blocks between the deep blocks, then ramming or rolling the blocks to bring their top faces to an even surface, then sprinkling the mass with sufficient water to cause the initial set to the hydraulic cement, then while the mass is still wet, filling the spaces between the

blocks with a grout composed of hydraulic cement, sand and water.

5. The process of making monolithic pavements which consists of depositing on a foundation of natural soil a dry concrete composed of crushed stone, sand and hydraulic cement thoroughly mixed, then imbedding therein while the concrete is still dry, paving blocks of sufficiently irregular depths to thoroughly bond together the dry concrete and the blocks, then ramming or rolling the blocks to bring their top faces to an even surface, then sprinkling the mass with sufficient water to cause the initial set to the cement, then while the mass is still wet, filling the spaces between the blocks with a grout composed of hydraulic cement, sand and water and then allowing sufficient time for the concrete to take its substantially permanent set from water obtained from the natural soil foundation by capillary attraction, before traffic is allowed.

6. A monolithic pavement, the bottom of which is formed of aggregate, sand and hydraulic cement and water, and the top of which is formed of stone blocks, certain of said blocks being relatively deep and the others relatively shallow, said blocks being arranged to form a smooth top and a relatively shallow block being arranged adjacent a relatively deep block so that the top and bottom are bonded together into a monolithic slab, the spaces between the blocks up to their top faces being filled with a grout of sand, cement and water.

7. The process of making monolithic pavements which consists of depositing on the natural soil a bottom part of aggregate, sand and hydraulic cement thoroughly and evenly mixed when dry, and of then imbedding therein stone blocks of which a substantial part are of different depths from the other part so that the dry mixture will work up between them, and they will stand up, then ramming the blocks to bring their top surfaces to substantially an even level, then moistening the top of the mix, and then filling the remaining spaces between the blocks to the top thereof.

8. In a pavement, the combination with the natural soil on which it rests, of a monolithic slab of which the bottom part is formed of a mixture of aggregate, sand and hydraulic cement mixed when dry to a uniform consistency throughout, and the surface is formed of stone blocks a substantial part of which are of substantially different depths from the other part, such blocks being embedded in the bottom mixture when dry so that it extends up between them, and a certain amount of moisture, together with a filling which extends substantially up to the top faces of the blocks.

HERBERT E. FLETCHER.