No. 693,192. Patented Feb. 11, 1902.

H. G. VOLKMAR.

PAVEMENT.

(Application filed May 16, 1901.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.

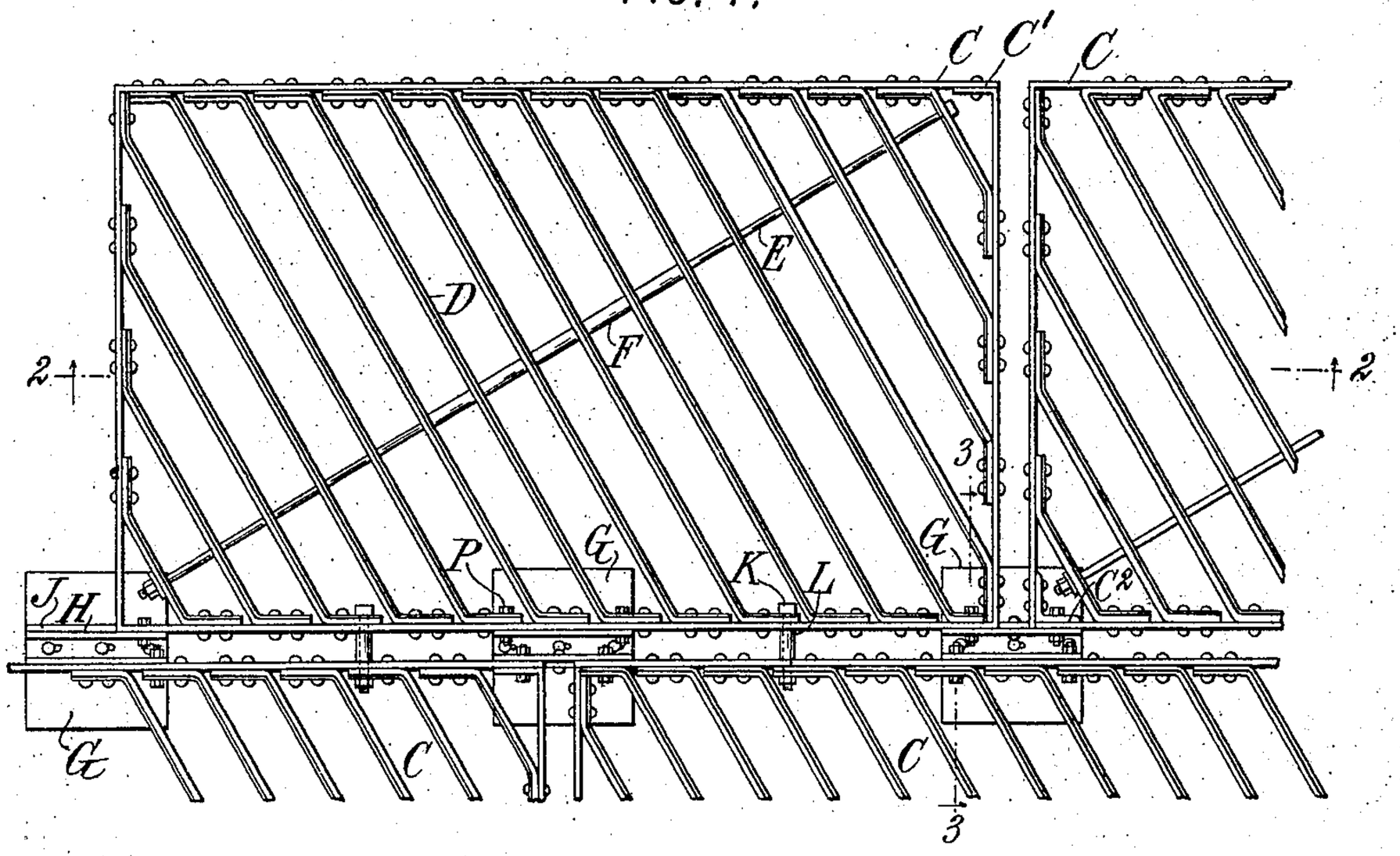


FIG. 2.

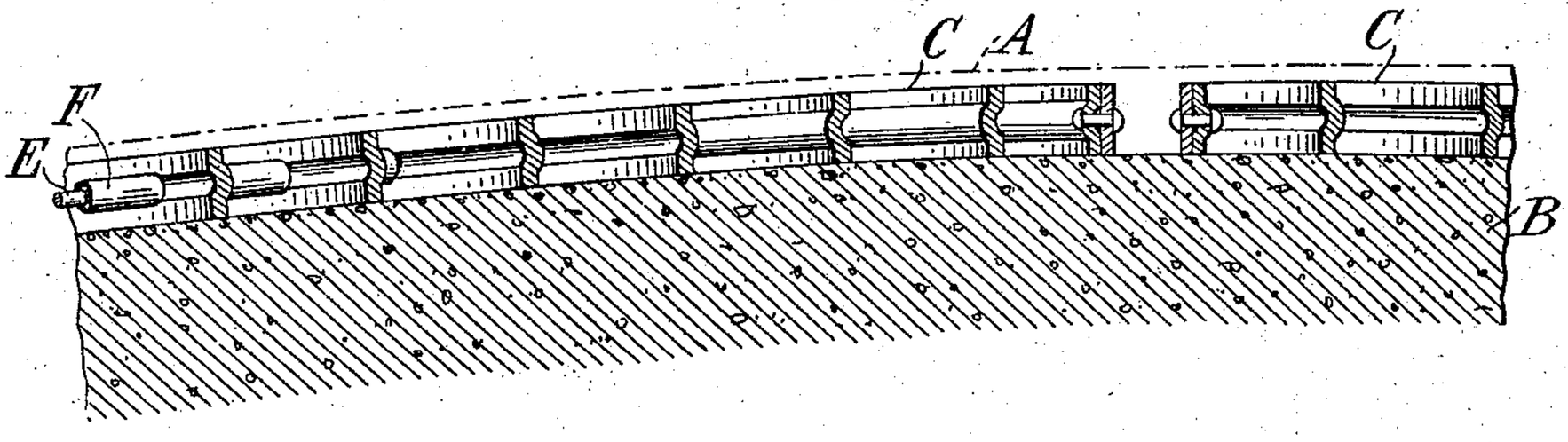


FIG. 3.

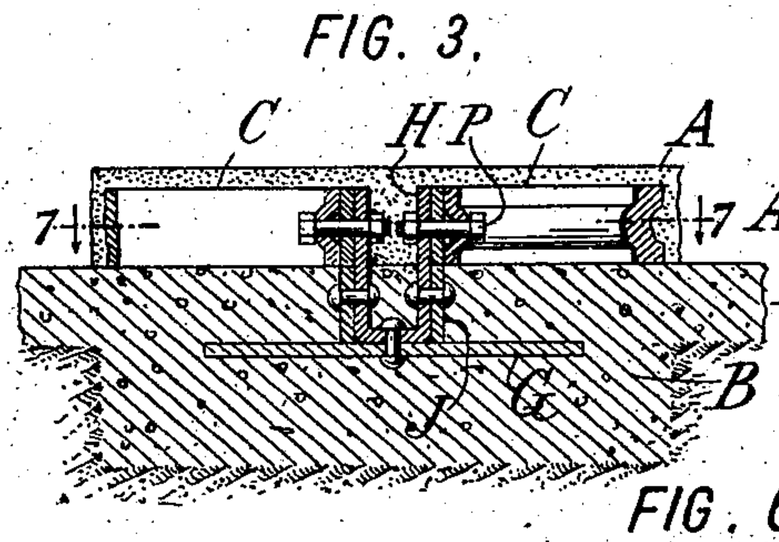


FIG. 4.

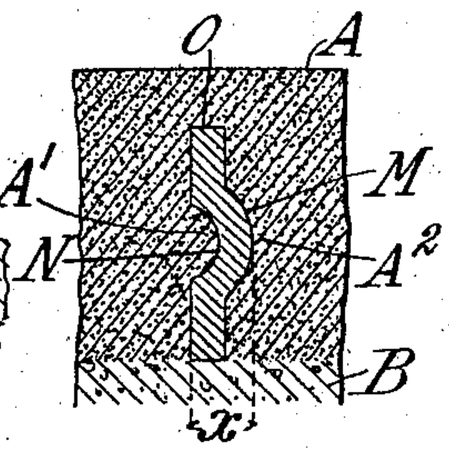


FIG. 5.

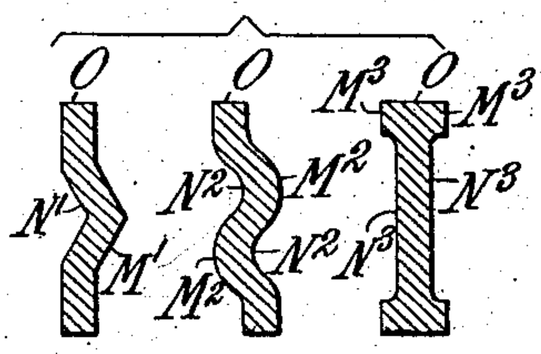
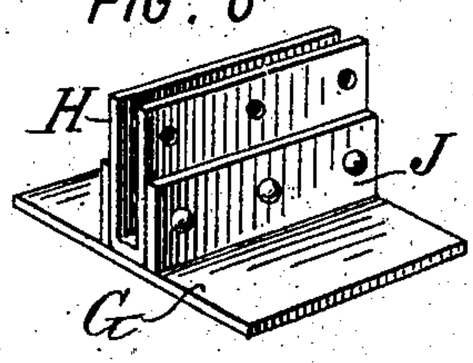


FIG. 6



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No. 693,192. Patented Feb. 11, 1902.

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(No Model.) 2 Sheets—Sheet 2.

FIG. 7.

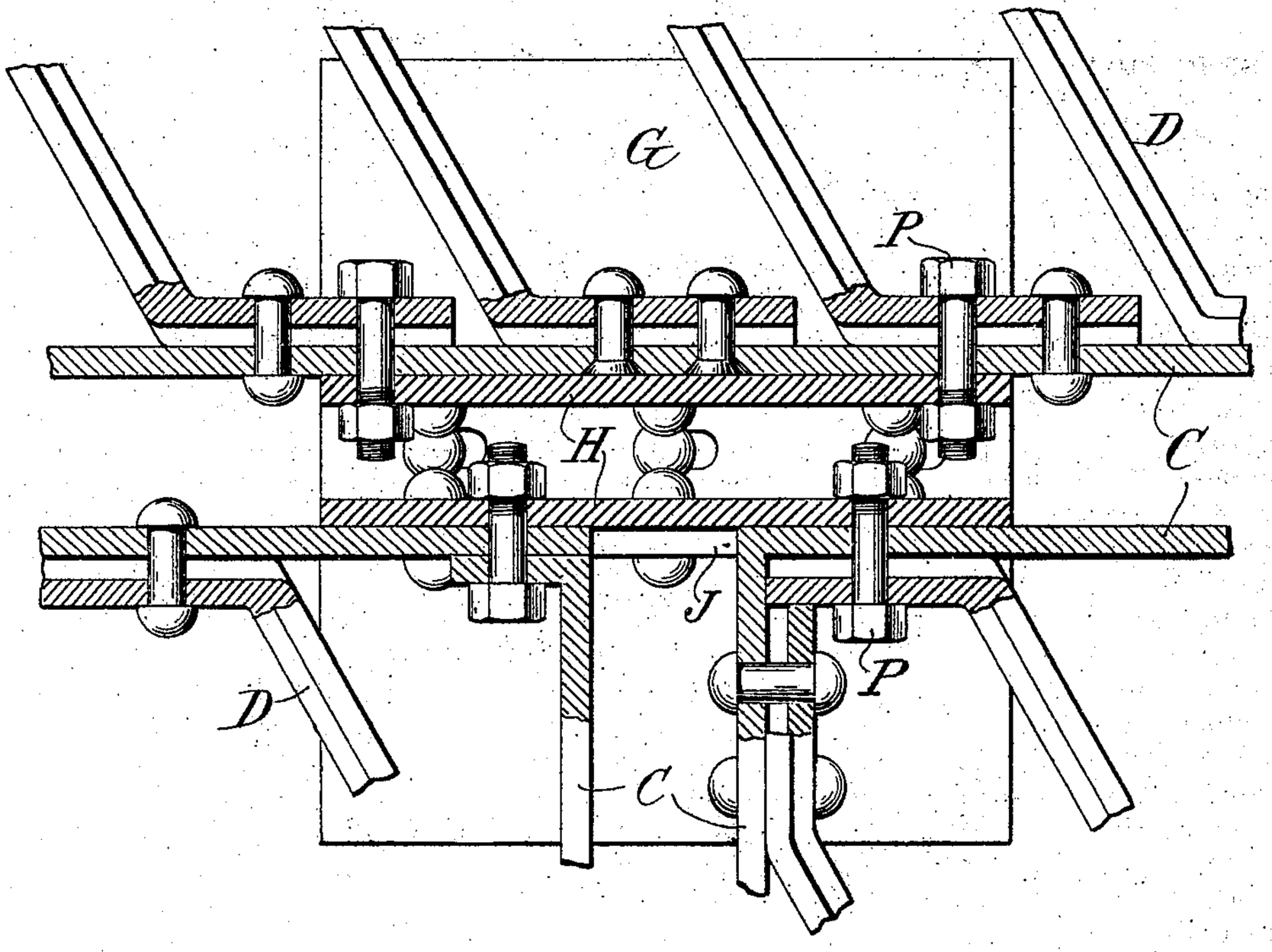


FIG. 8.

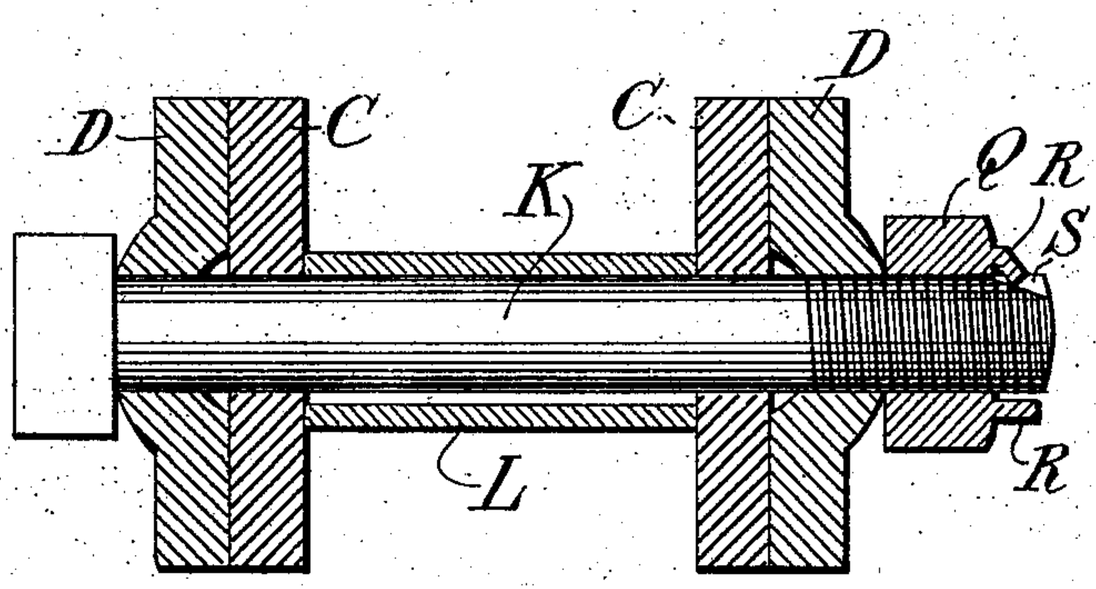
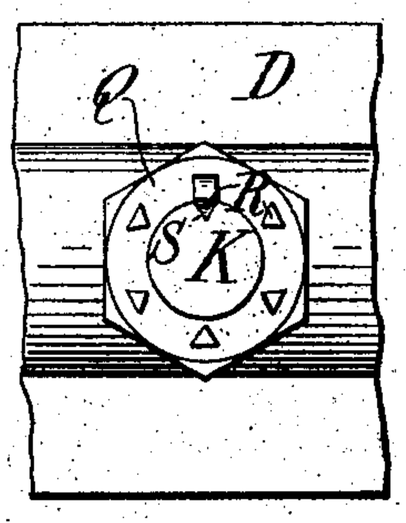


FIG. 9.



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UNITED STATES PATENT OFFICE.

HENRY G. VOLKMAR, OF NEW YORK, N. Y.

PAVEMENT.

SPECIFICATION forming part of Letters Patent No. 693,192, dated February 11, 1902.

Application filed May 16, 1901. Serial No. 60,521. (No model.)

To all whom it may concern:

Be it known that I, HENRY G. VOLKMAR, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Pavements, of which the following is a specification.

My invention provides improvements in pavements of asphalt or similar plastic material, whereby the pavement is maintained in good condition for a considerable time and whereby the wear of traffic and the consequent expense for repairs is very slight.

In asphalt pavements as generally constructed at present there is rapid deterioration, especially where the traffic is heavy, the surface wearing into holes and ruts, which are soon worn by breaking of their edges until they reach such dimensions as to imperatively require repair. It is also noticeable, especially in hot weather, that the asphalt creeps bodily, especially from the high center of the pavement to the low gutters, and is distorted by ridges of considerable size on its surface. These disadvantages are due in a large measure to the plasticity of the body of the asphalt even when fairly cold. The vertical pressure of a concentrated load is transmitted laterally for a considerable distance and not only depresses the surface at the point at which the load is concentrated, but causes it to bulge at neighboring points and to have a lateral movement which is always in excess in the downward direction and which accumulates at the sides or gutters. By means of my invention the body of the asphalt is divided into small and substantially independent sections, so that the pressure due to a load concentrated at any point is localized and the material is prevented from spreading or creeping.

My invention provides also various improvements in detail, as hereinafter set forth.

Referring to the accompanying drawings, illustrating an embodiment of my invention, Figure 1 shows in plan a system of frames for use in my improved pavements in the positions which they occupy in use, but with the plastic material omitted. Fig. 2 is a section, on an enlarged scale, on the line 2 2 of Fig. 1, the plastic material being omitted here also, but its surface being shown by a dotted line. Fig. 3 is a section on the line 3 3 of Fig. 1, the plastic material being in place. Fig. 4 is a section through a single bar of my improved frame. Fig. 5 shows several possible modifications of the bar illustrated in Fig. 4. Fig. 6 is a perspective of an anchor. Fig. 7 is a horizontal section through an anchor and the frames connected thereto on the line 7 7 of Fig. 3. Figs. 8 and 9 are a longitudinal section and an end view, respectively, along one of the bolts connecting adjacent frames, showing especially the manner of locking the same.

In the preferred form of my invention the division of the plastic material into independent sections is accomplished by embedding in the plastic material a stiffening-frame comprising wrought-metal bars having stiffening-ribs, whereby they are adapted to resist lateral deflection, so as to resist lateral transmission of vertical pressures on the asphalt. Preferably the stiffening-frame is slightly below the surface of the plastic material, so that without losing its localizing effect it permits of having a continuous surface common to each of the substantially independent sections into which the body of plastic material is divided. The bars forming the divisions between the several sections are made quite stiff transversely, so as to resist lateral deflection and prevent to a great degree the transmission of lateral pressure from one section to the next. Preferably the frame which I employ is made up of a number of individual frames, each being complete and self-contained, so as to serve its purpose in dividing the plastic material in that part of the pavement in which it lies independently of the other individual frames. By reason of this construction, also, when the pavement is injured at one point it can be taken up entirely, the stiffening-frame as well as the plastic body, over the space covered by one of the individual sections without disturbing the adjacent portions of the pavement.

Referring now to the drawings, A indicates a plastic material forming the body of the pavement and which may be laid upon any suitable foundation, such as the usual concrete foundation B. Embedded in the plastic material A is a frame, preferably made in individual sections C. The frame is prefer-

ably below the surface of the plastic material and extends to the bottom thereof, being directly supported on the foundation B. The frames may be substantially and cheaply made of rolled iron or steel. The side and end bars are preferably of rectangular section. The frame at the left of Fig. 1 is shown with its four side and end bars of a single piece of metal united by a lapped joint C′ at one corner. Obviously, however, the four bars may be of separate pieces joined at the corners either by a lapped joint or by means of an angle-iron, as shown at C^2. The internal bars D of each of the individual frames C C, and which form the dividing-walls between the adjacent independent sections of the plastic material, are preferably arranged diagonally and joined at their ends, as by bending and riveting, to the side and end bars. By the use of this form of connection the tendency of the bars to turn over under the lateral strains to which they are subjected is efficiently resisted. Preferably, also, to unite the entire frame strongly one or more tie-bars E may be employed, running transversely of the bars D.

Where the bar E passes through the bars D near the middle of the latter, the bars D are preferably stiffened laterally—as for example, by means of sleeves F, threaded on the bar E and forming braces between the adjacent bars D and spacing said bars apart.

In order to prevent the rocking of the frames C by an eccentric load, I may anchor them at each corner and preferably at an intermediate point on their long side. The anchor which I prefer to use has also the function of uniting the several frames which meet at a common point immediately above the anchor. Such anchor is preferably embedded in the base or foundation of concrete and projects above such base for attachment to the frame. Where the frames are laid so as to break joints with each other, as shown in Fig. 1, a single anchor may be attached to three frames. As shown in Figs. 3 and 6, the preferred construction of my anchor includes an anchor-plate G, a connecting-plate H, preferably of U shape, so as to permit of attachment to separate frames C C, and one or more supporting-plates J or similar means upon which the frames C may be supported at a greater or less distance above the anchor-plate G, according to the depth to which it is desired to bury the plate G in the base B. The mode of assembling these parts will be referred to hereinafter. I prefer also to provide an additional rigid connection between the individual self-contained frames C at points intermediate of the anchor-plates, which serves to resist in part the lateral strain due to a load upon the plastic material between adjacent frames. Such connection may consist, for example, of bolts K and spacers or sleeves L, Fig. 1, the former preventing relative movement in one direction and the latter preventing movement in the opposite direction.

In order to secure considerable stiffness in the bars O of my frame, so as to resist lateral deflection without using unnecessarily heavy material, I prefer to employ a bar having a considerable distance between its extreme right and left hand points, as shown by the distance x in Fig. 4. At the same time I find it useful to obtain this result by forming a sort of tongue M on one side and groove N on the other side of the bar, which tongue and groove may of course be varied considerably in outline, the groove of the form shown in Fig. 4 being cheap to roll and very efficient. The form shown in Fig. 5, however, in which the several tongues are shown by M′ M^2 M^3 and the several grooves by N′ N^2 N^3, or any one of various other forms will obviously serve the purpose. By reason of the shape of the bar, as shown in Fig. 4, the plastic material forms a tongue A′ in connection with the groove N and a groove A^2 in connection with the tongue M, which effectually resists any tendency to relative movement of the plastic material and the bar in a vertical direction.

In the construction of a pavement embodying in detail all the improvements above set forth I proceed as follows: The base of the pavement will consist of any suitable foundation laid in a well-known manner on the earth and, according to the customary practice, having a curved upper surface. Where the upper surface of the base B is curved, the frame C will be correspondingly curved; but it will be understood that these parts may be plane or that my improved pavement may be employed on any other suitable base—such, for example, as a bridge-floor—the foundation being modified to suit the special circumstances. Before the final layers of concrete are applied to bring the base B up to its proper grade the anchor-plate G is set in position so that the upper edge of the supporting-plates J are at the intended surface of the base, after which the concrete is brought up to grade, as usual. The sections C are then laid on the base B, the side bars resting upon the supporting-plates J and being fastened, as by bolts P, to the connecting-plates H, which are attached, as by riveting, to the anchor-plates G. The asphalt or similar plastic material is then filled in both within the frames C and in the space between the frames and to a height slightly above the upper edge of the frames, after which it may be rolled in the usual way to bring it to the desired evenness.

By reason of the independence of the various comparatively small sections into which my improved pavement is divided its life is very much longer than that of previous pavements, and it can stand very much heavier traffic without injury. There is no perceptible creeping. As is well known, the actual wear upon an asphalt surface is extremely slight, even under the heaviest traffic, the extensive repairs which the present asphalt

pavements have to undergo being due chiefly to the disadvantages which I have pointed out and almost never to actual wearing away of the surface. Therefore the small quantity of material which is above the frames in my improved pavement will last for a very great length of time. In ordinary asphalt pavements the upper surface is harder than the lower portions. When this upper surface is destroyed at any point, the softer material underneath is rapidly worn to the bottom, and at the same time the upper edge of the hole is rapidly enlarged, so that the hole is soon so deep and wide as to imperatively demand repair. When a hole appears in the upper surface of my improved pavement, it cannot extend to a depth greater than the depth of asphalt above the frame. The members of the frame of my improved pavement are preferably so close together that wheels of ordinary size always bear substantially directly on at least one of the frame members, so that the upper crust is supported at all points. Even when the crust is broken at a single point the edges of the hole are supported by the frame, so that the widening of the hole is much less rapid than where the edges of the hole are supported only by the comparatively soft asphalt underneath. Also with my pavement the hole cannot wear deeper than the depth of the upper edges of the frames below the surface of the pavement, and after a considerable space has been worn to such a depth it is a very simple matter to rebuild the worn parts and bring them up to their original surface.

The frame in my improved pavement thus not only confines the plastic material into small substantially independent sections, so as to prevent lateral yielding, but serves itself to transmit the loads to the foundation in a direct vertical line and by reason of its plane bearing to distribute concentrated loads over comparatively wide areas of the foundation.

By the use of wrought-metal bars stiffened against lateral deflection I secure any desired amount of resistance to vertical pressures, freedom from breakage under shock, frost, or the like, a pavement which is chiefly asphalt, so as to have all the advantages of a solid asphalt pavement, and a stiffness laterally which prevents deterioration due to the plasticity of the asphalt.

By reason of the mode of operation described the depth of concrete under the plastic material does not need to be so great as in pavements where a concentrated load is supported only upon a small area of the concrete foundation. This foundation may therefore be either of considerable depth throughout, as shown in Fig. 2, or of scarcely greater depth in general than that of the plastic material, as shown in Fig. 3, being made somewhat deeper immediately under the anchors, so as to give them a firm support.

There is always considerable jarring of the frames and their connections, and for this purpose it may be found advisable to lock the bolts—such as K, E, or P—which are used to connect the various parts. A very convenient form of nut for preventing the loosening of these bolts is shown in Figs. 8 and 9 applied to the bolt K. In this construction the nut Q is preferably made of soft iron and is provided at its outer face with any desired number of projecting lugs R of preferably triangular cross-section, which are adapted to be bent down, as by the blow of a hammer, and fitted into a groove S in the end of the bolt after the nuts have been screwed home. The greater the number of lugs R on the nut the nicer the adjustment which can be obtained and the more often the same nut can be used. In order to unscrew the nut, the lug R can be very quickly and easily cut off, the nut being capable of reuse with any one of the remaining lugs. This locking mechanism is of especial use in my improved pavement, because of the continual jarring to which it is subjected and the invisibility and inaccessibility of the nuts for inspection or for tightening them when they are loosened.

It will be apparent that the advantages of my improved pavement may be obtained without adhering exactly to the specific embodiment shown.

Various modifications in the details and arrangement of the parts may be made without departure from the spirit of my invention, and various alterations of particular elements may be possible without sacrificing the advantages of other elements thereof. It will be understood, therefore, that I do not limit myself to the specific embodiment shown and described.

I claim as my invention—

1. In a pavement, the combination of a body of asphalt, and a stiffening-frame open at the top and bottom and embedded in said asphalt, said frame comprising wrought-metal bars having stiffening-ribs whereby they are adapted to resist lateral deflection so that the asphalt is divided into substantially independent sections so as to resist lateral transmission of vertical pressures on said asphalt.

2. In a pavement, the combination of a body of asphalt, and a stiffening-frame open at the top and bottom and embedded in said asphalt, said frame comprising wrought-metal bars having stiffening-ribs whereby they are adapted to resist lateral deflection so that the asphalt is divided into substantially independent sections so as to resist lateral transmission of vertical pressures on said asphalt, and said frame being below the surface of said asphalt whereby said independent sections have a common continuous surface.

3. In a pavement, the combination of a body of asphalt, and a stiffening-frame open at the top and bottom and embedded in said asphalt, said frame comprising side bars, end bars and internal bars, the latter being of wrought metal and having stiffening-ribs, whereby they are adapted to resist lateral deflection

so that the asphalt is divided into substantially independent sections so as to resist lateral transmission of vertical pressures on said asphalt.

4. In a pavement, the combination of a body of asphalt, and a stiffening-frame open at the top and bottom and embedded in said asphalt, said frame comprising side bars, end bars and internal bars, the latter being of wrought metal and having stiffening-ribs whereby they are adapted to resist lateral deflection so that the asphalt is divided into substantially independent sections so as to resist lateral transmission of vertical pressures on said asphalt, and braces between said internal bars for bracing the same transversely.

5. In a pavement, the combination of a body of asphalt, and a stiffening-frame open at the top and bottom and embedded in said asphalt, said frame comprising side bars, end bars and internal bars, the latter running crosswise of the side bars and being bent at their ends parallel to said side bars, and said bent ends being fastened to said side bars.

6. In a pavement, the combination of a body of asphalt, and a stiffening-frame embedded therein, said frame comprising plain side bars and end bars and additional internal wrought-metal bars O having tongues M and grooves N whereby said bars are stiffened against lateral deflection so as to resist lateral transmission of vertical pressures on said asphalt and are interlocked with said asphalt so as to resist relative vertical movement of said frame and said asphalt.

7. In a pavement, the combination of a body of asphalt, and a stiffening-frame embedded therein, said frame comprising plain side bars and end bars and additional internal bars O running crosswise of the side bars and being bent at their ends parallel to said side bars, and said bent ends being fastened to said side bars, said bars O having tongues M and grooves N whereby said bars are strengthened against lateral deflection so as to resist lateral transmission of vertical pressures on said asphalt and whereby said bars are interlocked with said asphalt so as to resist relative vertical movement of said frame and said asphalt.

8. In an asphalt pavement, the combination of an asphalt body and a stiffening-frame embedded therein, said frame being open at the top and bottom and comprising side and end bars, diagonal internal wrought-metal bars connecting said side and end bars, and a diagonal tie-rod arranged transversely of said internal bars, said bars having stiffening-ribs whereby they are adapted to resist lateral deflection so that the asphalt is divided into substantially independent sections so as to resist lateral transmission of vertical pressures on said asphalt.

9. In an asphalt pavement, the combination of an asphalt body, complete self-contained stiffening-frames open at the top and bottom and embedded in said asphalt body below the surface thereof, the adjacent frames being detachably connected to each other.

10. In an asphalt pavement, the combination of a concrete base, an asphalt top layer, a series of frames embedded in said asphalt side by side, and anchors fastened to said frames at adjacent edges thereof and embedded in said concrete base.

11. In an asphalt pavement, the combination of an asphalt body, a frame therein, and an anchor for said frame comprising an anchor-plate, means for supporting said frame above said anchor-plate, and means for attaching said frame to said anchor-plate above the latter.

12. In an asphalt pavement, the combination of an asphalt body, a frame therein, and an anchor for said frame comprising an anchor-plate G, a connecting-plate H adapted for attachment to said frame, and a supporting-plate adapted to support said frame above said plate.

13. An anchor for use in anchoring frames in pavements or the like comprising an anchor-plate, means for supporting said frame above said plate, and means for attaching said frame to said anchor-plate above the latter.

14. An anchor for use in anchoring frames in pavements or the like comprising an anchor-plate, means for supporting said frame above said plate, and means attached to said plate and adapted for attachment to said frame.

15. An anchor for use in anchoring frames in pavements or the like comprising an anchor-plate, a connecting-plate and a supporting-plate adapted to support a frame above said anchor-plate.

16. In an asphalt pavement, the combination of an asphalt body, complete self-contained stiffening-frames embedded therein below the surface thereof, and breaking joints with each other, and an anchor attached to each of three frames at their meeting-point.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HENRY G. VOLKMAR.

Witnesses:
DOMINGO A. USINA,
FRED WHITE.