D. S. COLE & H. B. GILLETTE.

ROAD CONSTRUCTION.

APPLICATION FILED OCT. 23, 1915.

1,254,401.

Patented Jan. 22, 1918

3 SHEETS—SHEET 1.

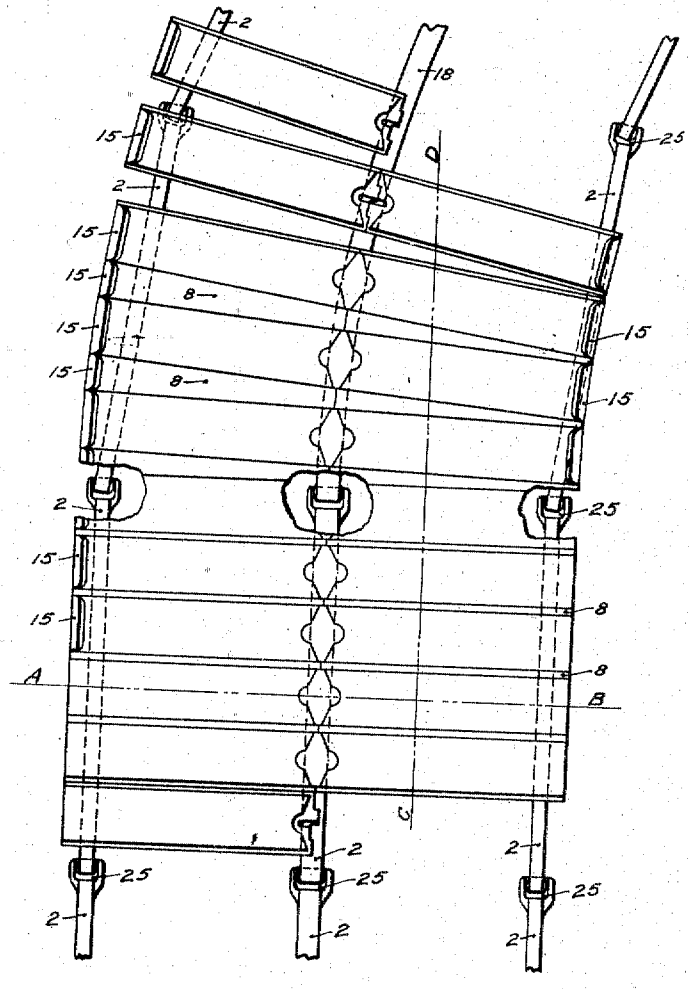


Fig. 1.

Witnesses

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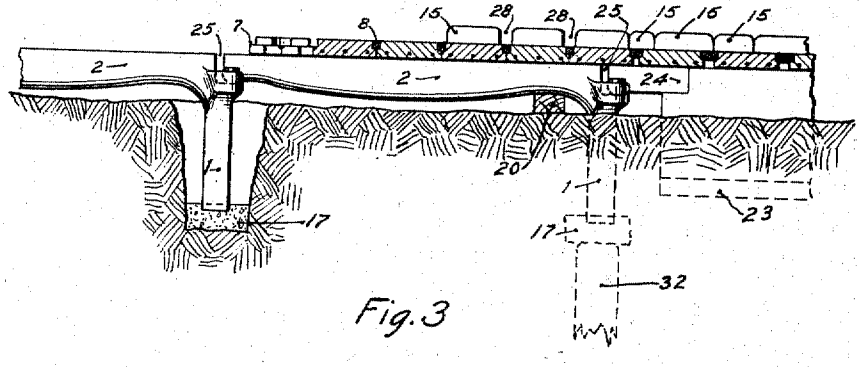


Fig. 3

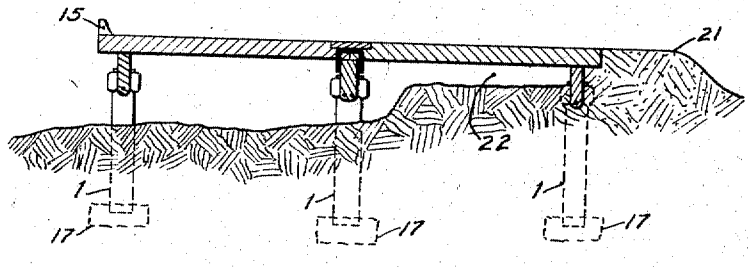


Fig. 2

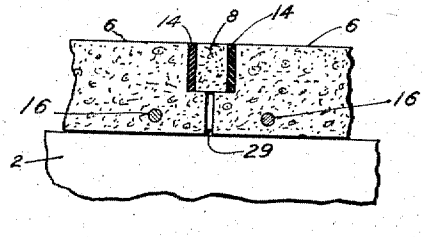


Fig. 4

Witnesses

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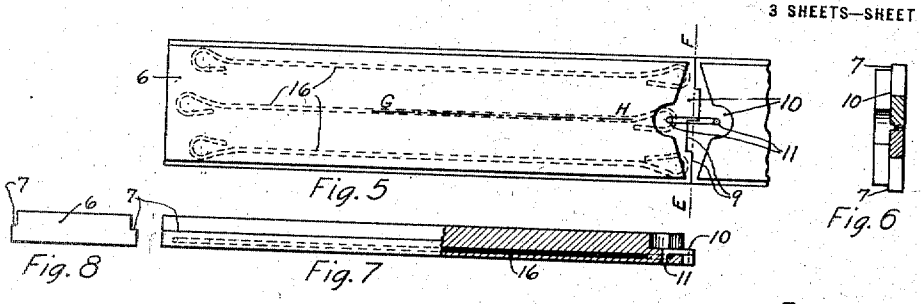


Fig. 5

Fig. 6

Fig. 8

Fig. 7

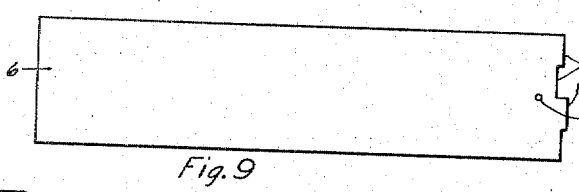


Fig. 9

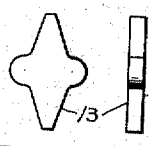


Fig. 10 Fig. 11

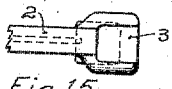


Fig. 15

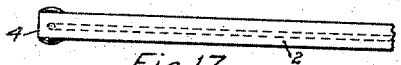


Fig. 17

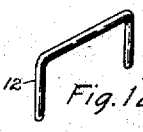


Fig. 12

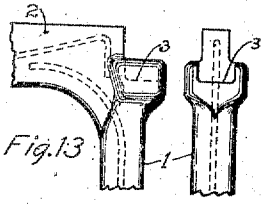


Fig. 13

Fig. 14

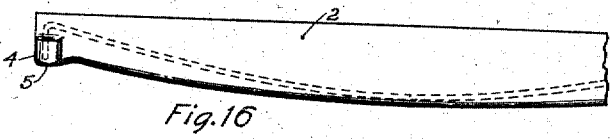


Fig. 16

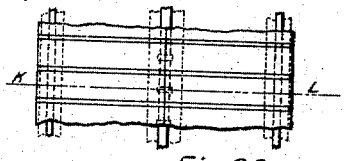


Fig. 20

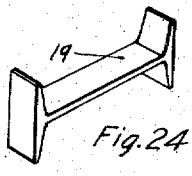


Fig. 24

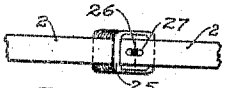


Fig. 19

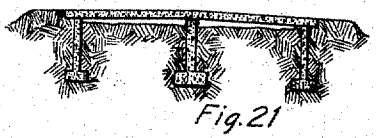


Fig. 21

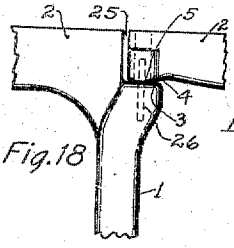


Fig. 18

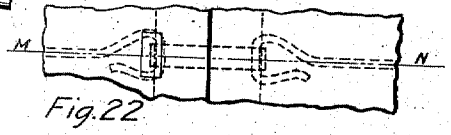


Fig. 22

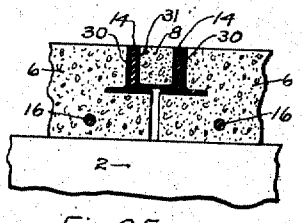


Fig. 25

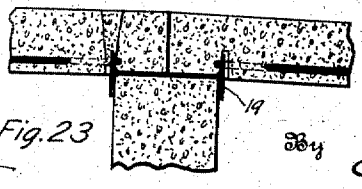


Fig. 23

Witnesses

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UNITED STATES PATENT OFFICE.

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ROAD CONSTRUCTION.

1,254,401. Specification of Letters Patent. Patented Jan. 22, 1918.

Application filed October 23, 1915. Serial No. 57,493.

To all whom it may concern:

Be it known that we, DWIGHT S. COLE and HERBERT B. GILLETTE, citizens of the United States, residing in the city of Grand Rapids, in the county of Kent and State of Michigan, have invented a new and useful Road Construction, of which the following is a specification.

Our invention relates to a road or highway construction, and more particularly to a road or highway of a durable type having a top or wear surface of suitable material, as concrete, asphalt, or other combinations of ingredients suitable for the purpose, capable of being formed or molded while in a plastic condition, and which will become strong and durable by hardening after being formed into the desired shape.

The objects of our invention are to produce a construction for the purpose which is durable and efficient in service; simple, economical and easy to construct and repair, and in which the construction is made up of elements or units so designed that most of them can be formed and finished by factory methods, at plants for the purpose, and then readily transported and assembled and joined together, with suitable provision for contraction and expansion, to form an efficient structure for highway or other traffic purposes. These, and other objects of our invention will be more fully disclosed by the following description and referring to the accompanying drawings, forming a part of this specification, and the novel features combined in our invention are particularly specified in the accompanying claims.

A road or traffic-carrying structure constructed in accordance with our invention comprises in combination firmly mounted supporting walls or girders longitudinal of the roadway or direction of traffic; floor slabs or units laid crosswise of and resting upon said longitudinal walls or girders and prevented from lateral displacement, with respect to the line of said roadway, by being secured to one of said longitudinal walls or girders by suitable means; ledges or other means provided on the adjoining portions of said floor slabs for supporting and holding joint members resting thereon; joint members between the adjoining portions of said floor slabs and supported by said ledges or means, and a suitable filling, as coal tar, asphalt, or other bituminous or somewhat elastic material, forming the joints between said floor slabs and said joint members therebetween.

In order to avoid much of the large expense heretofore met with in the construction of standard concrete roads, we have planned our structure along radically different lines than heretofore employed for such constructions.

In our improved construction we employ concrete, with steel reinforcements where required, exclusively, except that a bituminous filler is used to make the joints waterproof and also to provide therein for the contraction and expansion of the floor members. The floor of our road is carried, free from bottom contact with the earth beneath, on suitable walls or girders supported on suitable concrete footings embedded in the earth at a depth below the harmful action of frost. All rolling and surface preparation of the earth work, by the addition to the surface thereof of crushed stone, gravel or sand, is dispensed with. Trenches or pits in the earth, to receive the footings for supporting the said supporting walls or girders, constitute the only work ordinarily required on the roughly graded roadway to prepare same to receive the concrete walls or girders carrying the floor. A very large portion of the concrete structure is so designed as to be made by factory methods at plants conveniently located as to supplies for producing the concrete. The transportation of the completed units of the concrete for the structure from the manufacturing plant to the site of their placing can generally be done over the completed road, as the road can be thrown open to traffic quickly after the completed and cured factory-made parts are assembled and joined to form the completed structure. Evidently our improved construction, as outlined above, has many advantages, from the constructive point of view, over that commonly heretofore employed for building concrete roads.

How we accomplish the construction

above outlined can readily be understood by referring to the accompanying drawings and their explanation hereinafter.

Referring now to the drawings:

Figure 1 is a top or plan view, with portions cut away, showing an assemblage of the units constituting one form of our improved road construction and how these units adapt the construction to both straight and curved roads; Fig. 2 a cross-sectional elevation of this form of our improved construction taken on line A—B of Fig. 1; Fig. 3 a longitudinal sectional elevation of same taken on line C—D of Fig. 1; Fig. 4 an enlarged cross-sectional view of the joint between the adjoining sides of two of the floor slabs, taken on the straight section of the road on line C—D of Fig. 1; Fig. 5 a top view of one form of our improved floor slab with a portion of another similar slab interlocked therewith at one end thereof; Fig. 6 a cross-section of Fig. 5 on line E—F; Fig. 7 a side elevation, partly in section on line G—H, of the full slab shown by the top view in Fig. 5; Fig. 8 an end view of Fig. 7; Fig. 9 a bottom view of the form of our floor slab disclosed in its other forms by Figs. 5, 6, 7 and 8; Fig. 10 a top or plan view of the block or joint member adapted to fit into the recess shown at the junction of the ends of the slabs shown in Fig. 5; Fig. 11 a side elevation of Fig. 10; Fig. 12 a perspective view of the form of metallic locking device employed with the type of joint shown in Figs. 5 and 7 to secure the slabs together endwise and also to secure the floor slabs in position laterally with respect to the longitudinal supporting walls or girders, as shown clearly in Fig. 2; Fig. 13 a side elevation of the knee portion of one form of our combined girder and post employed in one form of our improved construction, as shown more fully in Figs. 1, 2 and 3; Fig. 14 an endwise view of Fig. 13; Fig. 15 a top view of Fig. 13; Fig. 16 a side elevation of the central portion and free end of the girder portion of our combined girder and post, having a form at the free end thereof adapted to member with the socket shown in Figs. 13, 14 and 15; Fig. 17 a top view of Fig. 16; Fig. 18 a side elevation of the end portions of our combined girder and post showing another method whereby they may be flexibly interlocked; Fig. 19 a top view of Fig. 18; Fig. 20 a top view of a section of our improved road construction showing another form of joint where the ends of the floor slabs come together; Fig. 21 a sectional elevation on line K—L of Fig. 20; Fig. 22 an enlarged top view of the central portions at the end junction of two of the floor slabs, shown less distinctly in Fig. 20; Fig. 23 a central sectional elevation on line M—N of Fig. 22, shown less distinctly in the central portion of Fig. 21; Fig. 24 a perspective view of the metallic locking device employed with the type of floor slab shown in Figs. 20 and 21—sectional elevations of which are shown in Figs. 21 and 23, and Fig. 25 a view, taken similarly to Fig. 4, showing special metal reinforcements at joints.

Like numbers refer to the same parts throughout the drawings.

Of the parts shown by the several figures, 1 is the post or leg portion of our combined girder and post; 2 the girder portion thereof; 3 the ledge forming the support for the free end of girder 2 at the top of post 1; 4 the free end of the girder adapted to rest upon ledge 3; 5 the under or bottom surface, at the free end 4 of the girder, adapted to rest upon ledge 3 at top of post 1; 6 the floor slabs or large units of the flooring of our improved construction; 7 the ledges on lateral edges or sides of floor slabs 6; 8 the joint members or small lateral units of the flooring adapted to rest upon ledges 7 between the lateral edges of slabs 6; 9 the interlocking portions of the ends of slabs 6; 10 the ledges at interlocking ends of slabs 6; 11 the perforations through ledges 10; 12 the metallic staple, shown in Figs. 2 and 12, adapted to secure two of the floor slabs 6 together endwise and to the girder or wall beneath; 13 the central units of the flooring adapted to rest upon ledges 10 at the interlocking ends of slabs 6; 14 the bituminous or other somewhat elastic filling in the joints between the units forming the floor surface; 15 the curb at outer end of floor slabs 6; 16 the bars reinforcing floor slabs 6; 17 the footing provided at bottom end of post 1; 18 the wall forming the middle girder on curves, as shown in Figs. 1 and 3; and 19 a form of metallic fastening employed to interlock two floor slabs and one girder in another form of the joined ends of the main floor slabs, whereby the member shown in Figs. 10 and 11 is dispensed with and but a single joint exists, at the abutting ends of the floor slabs, to be filled with the joint-making material.

In Fig. 25 a type of reinforcement for floor slabs 6 and additional floor members 8 is shown in cross-section. The inverted **T** bars 30, applied to the sides of slabs 6, as shown, serve to greatly strengthen the slabs against breaking, and the web of said bars serves to prevent the edge of the concrete at the top of the slabs from being fractured or chipped off by traffic. Ledges 7 are also greatly strengthened by the exposed flanges of the **T** bars. Member 8, of the flooring, is here shown to be formed in a trough of metal 31 adapted to be placed as shown and secured there by the filling material 14 in the joints. Such metallic troughing serves as forms for molding members 8 accurately, also to protect same from fracture in han-

dling and by traffic after being embedded in the road floor.

The foregoing references to the drawings should render the essential features of our improved road construction clear to those skilled in the art to which it pertains. It is pertinent, however, that we state that in the pictorial representation of our new construction, shown by the drawings herewith, no attempt has been made to show the exact proportions of parts or forms of details which competent engineers may determine to be the best for any particular installation. The same is true as to the matter of reinforcing the several parts by the use of metal bars built into the concrete, and while we have indicated the use of such reinforcing bars no effort has been made to show to what extent such reinforcement may be found necessary or how it can best be arranged.

How some of the objects of our invention hereinbefore specified are achieved by the construction shown by the drawings will now be specifically pointed out.

By referring to the drawings it will be seen that the type of joint employed, where the free end, 4, of the girder rests upon the ledge 3 near the top of post 1, provides for swinging the consecutive girders laterally out of alinement to adapt that construction to the outer supporting members at curves, as clearly shown in the upper portion of Fig. 1. A further inspection of Fig. 1 shows that in the preferred construction on curves the middle support for the floor slabs is preferably a solid concrete wall 18 following the center line of the road. Such a wall can best be built in place and is of such a depth and form as conditions may require, and, as indicated in Fig. 3, it may have a special footing 23 and be connected to the girder-post adjoining by a slab 24 resting at one end on the post and at the other end built into the wall.

Provision for the longitudinal expansion of the girders is clearly shown at 25 in Figs. 1, 3, 18 and 19. The provision for expansion of floor slabs 6 longitudinally of the roadway (in the direction of the width of said slabs) is shown at 29 in Fig. 4, the said slabs being separated throughout their length by a sufficient space for that purpose. The somewhat elastic joint-filling material 14 in the joints above ledges 7 serves to permit of the lateral expansion of slabs 6 and at the same time forms tight joints between the units of the road floor. An inspection of Figs. 16 and 18 discloses that the contact surface 5 at the bottom of the end of the girder is curved, and as this curve rests on a flat surface on ledge 3 it adapts the construction to changes of grade either to higher or lower levels, while the comparatively narrow floor slabs laid crosswise upon the girders constitute means adapting the floor to changes of grade in conformity to the changes of grade made by the successive sets of girders.

In the form of connection shown by Figs. 1, 2, 3, 13, 14, 15, 16 and 17, the construction admits of a considerable variance in longitudinal placing of the parts, with a consequent variance of the gap 25, while all lateral movement is prevented, as shown. In the construction shown by Figs. 18 and 19 lateral displacement is prevented by the strong metallic pin 26, set in post 1, coacting with the side walls of the slot 27 in the end of the girders, as clearly shown.

Upon curves the joint units, 8, of the floor are made special, having one end wider than the other, to suit the degree of curvature required. This feature constitutes one of the most important elements of our improved construction, as it adapts our regular main floor slabs 6 to either straight or curved roads without any change in their construction. The ledges 7 on the slabs 6 can be so made as to carry the small lateral units of the flooring 8 securely regardless of the span their widest ends may cover. On curves, particularly those on steep hillsides, the construction may very advantageously embody the use of curbs 15 and 15′, at both edges of the pavement—such curbs to be constructed integrally with floor slabs 6 and the small lateral units 8 of the flooring. Ordinarily on straight roads where curbing is desirable, as on high embankments or where ditches are at the side of the driveway, the curbing is preferably on floor slabs 6 only, thereby leaving gaps 28 between the slabs 6 at the margins of the pavement for draining the surface of the road perfectly, and at the same time the curbing is so nearly continuous as to be entirely adequate.

From the foregoing descriptions and the constructions shown by the drawings it is evident that but a slight departure in the form of one end of the floor slab 6 is necessary to adapt same to being singly interlocked with a single wall or girder by either of the metallic locking devices shown— the staple 12 or section of I beam 19, or any equivalent means. A narrow road constructed in accordance with the essential principles of our invention comprises two parallel walls or lines of girders, firmly set longitudinally of the roadway, with a flooring of our slabs 6 crosswise thereon—each slab being as long as the pavement is wide and secured at or near one of its ends only to one of the longitudinal walls or girders, the other end of each slab being free to move slightly crosswise of the other wall or girder as may be necessary to care for contractions and expansions of the floor slabs in the direction of their length. The inter-

locked end as well as the free end of each such slab may extend outward beyond its respective wall or girder, as shown at the left of Fig. 2. We deem the above description of the adaptation of the principles of our invention to narrow road constructions adequate to make same plain, to those skilled in such arts, without illustrating same in the drawings.

That the advantages of our improved construction may be more fully disclosed than hereinabove set forth we will now enlarge upon what we have outlined, in the comparison of merits in setting forth the objects of our improved construction, and thereby aid in making more clear the wide and perfect adaptability of our invention for concrete road construction.

The first large item wherein the economy of our improved construction is very apparent lies in the small amount of earthwork ordinarily required to prepare for assembling the factory-made parts on the special footings to complete a strong, rigid and durable road structure. In the ordinary case of our construction a turnpike is roughly formed to a grade considerably below that of the final road surface. Into such turnpike rows of holes at proper intervals are dug to a depth sufficient to insure a firm setting of the post portion of our new combined girder and post. Upon the graded earth between the longitudinal rows of holes a sectional construction railway may readily be placed. Over such tracks the girder and post units may be easily transported and distributed along the right of way. Likewise the materials for the concrete footings 17 may be transported and deposited at suitable intervals. Following the depositing of these materials along the roadway an erecting crane may travel along the rails and swing the girder-post units into position where they may be quickly lined up and the foot of each post embedded in the fresh concrete deposited for that purpose in the holes, preferably after the posts are correctly lined up in place. Temporary shorings, as the piece of wood 20 in Fig. 3, serve to hold the girders to grade until the footings of concrete harden sufficiently to take the load, after which the shorings are removed and the holes filled with firmed earth to provide a side support to the posts to hold the girders in the desired alinement. No further earthwork whatever is required to prepare for laying the floor slabs. Upon the rows of girders thus erected a traveling crane is mounted and places the floor slabs in position in its rear. Transportation of the floor slabs to near the site of their laying can be done over the completed portion of the road day by day as the surfacing progresses, while a construction track on suitable timbers can be laid immediately upon the newly placed floor slabs to enable the forwarding of the slabs over the short newly laid section.

After laying the floor slabs and completing the concrete portion of the road, where conditions warrant, the earth is filled in at the sides to provide a margin at grade, as shown at 21 in Fig. 2. Where such marginal earthwork is employed the earth under the outer ends of the floor slabs and against the outer face of the girders there is rammed firmly in place, but between the rows of girders the earth is left rough and considerably lower than the bottom of the floor slabs, as indicated at 22 in Fig. 2.

From the above it can be seen that the amount and character of the earthwork involved in our improved road construction is very slight in comparison with that involved in the construction of standard concrete roads, as hereinabove described. The fact that most of the transportation of the heavy and bulky materials used in the construction can be done over the completed road by motor trucks and trailers insures that the cost of transporting materials in our improved construction is much less than is possible under the systems of construction heretofore employed, as outlined heretofore.

Where flat land of a mucky or soft character is encountered in constructing roads the great advantage of our improved construction is very evident. Our factory-made unit construction permits of the completion of a firm and durable road over such ground without any grading whatever. A construction floor of timbers may be required to carry a machine to drive rows of piles to a depth such that their tops will be below the bottoms of the posts of our new girder-post construction. The erection of the girders and concreting in of the posts over the tops of the piles follows at once upon the driving of the piles and the laying of the floor slabs can soon be done, so that the finished road surface can follow the driving of the piles within a short distance—thus the transportation of materials to the site of utilization is greatly facilitated by our new construction. In crossing such ground the type of floor slab having a curb constructed integrally therewith at its outer end, as shown at 15 in Figs. 1, 2 and 3, is desirable and the surface of such road may be well up above the surface of the ground above high water levels, as shown clearly by that portion of Fig. 2 at the left of the center thereof.

In constructions where our girder-post units are employed in crossing soft earth, as muck, a system of lateral cross ties joining the posts at intervals serves to prevent the toppling-over of the girders, particularly where curves occur. Such lateral cross ties are preferably designed of a form embodying a stiff beam having a stiff leg rigidly joined to and depending from each of its

ends—said legs being firmly secured to the post portion of our combined girder-post units. The cross ties just described are not shown in the drawings, but this description will suffice to show that we have anticipated possible difficulties of maintaining the roadway against toppling over and have evolved a means for preventing same.

Having thus illustrated and described the general features of our invention, and pointed out its principal features of special merit in comparison with what is considered the best recent practice in such constructions, we would include as within the scope of our invention such departures from the details shown as may be evolved in connection with the further development of such minor details.

What we claim is:

1. In a road construction, the combination of parallel rows of firmly mounted floor-supporting members longitudinal of the roadway; floor slabs cross-wise of and resting upon the top surfaces of said floor-supporting members, and means for securing one end of each of said floor slabs to one of said floor-supporting members so as to prevent the movement of said floor slabs cross-wise of said floor-supporting member—the other or unsecured ends of said floor slabs resting at or near their ends upon the top surface of another of the floor supporting members and being free to move thereon.

2. In a road construction, the combination of parallel rows of firmly mounted floor-supporting members longitudinal of the roadway; floor slabs cross-wise of and resting upon the top surfaces of said floor supporting members; means for securing one end of each of said floor slabs to one of said rows of floor-supporting members so as to prevent the movement of said floor slabs cross-wise of said floor-supporting member—the other or unsecured ends of said floor slabs resting at or near their ends upon the top surface of another of the floor-supporting members and being free to move thereon, and means for making tight joints between the adjoining edges of said floor slabs.

3. In a road construction, the combination of parallel rows of firmly mounted floor-supporting members longitudinal of the roadway; floor slabs cross-wise of and resting upon the top surfaces of said floor-supporting members; means for securing one end of each of said floor slabs to one of said rows of floor-supporting members so as to prevent the movement of said floor slabs cross-wise of said floor-supporting member—the other or unsecured ends of said floor slabs resting at or near their ends upon the top surface of another of the floor-supporting members and being free to move thereon; means for making tight joints between the adjoining edges of said floor slabs, and a curb at either or both margins of the driveway—said curb being constructed integrally with the outer ends of the floor slabs and rising above the traffic surface thereof to form a barrier to prevent vehicles from running off from the driveway.

4. In a road construction, the combination of parallel rows of firmly mounted floor-supporting members longitudinal of the roadway—each row of said floor-supporting members comprising a series of consecutive girders, each of which has a supporting post constructed integrally with and depending from one of its ends and means at the top portion of said post for supporting and maintaining in lateral position the end of the next consecutive girder thereto; floor slabs cross-wise of and resting upon the top surfaces of said floor-supporting members, and means for securing one end of each of said floor slabs to one of said floor-supporting members so as to prevent the movement of said floor slabs cross-wise of said floor-supporting member—the other or unsecured ends of said floor slabs resting at or near their ends upon the top surface of another of the floor-supporting members and being free to move thereon.

5. In a road construction, the combination of parallel rows of firmly mounted floor-supporting members longitudinal of the roadway—each row of said floor-supporting members comprising a series of consecutive girders, each of which has a supporting post constructed integrally with and depending from one of its ends and means at the top portion of said post for supporting and maintaining in lateral position the end of the next consecutive girder thereto; floor slabs cross-wise of and resting upon the top surfaces of said floor-supporting members; means for securing one end of each of said floor slabs to one of said floor-supporting members so as to prevent the movement of said floor slabs cross-wise of said floor-supporting member—the other or unsecured ends of said floor slabs resting at or near their ends upon the top surface of another of the rows of floor-supporting members and being free to move thereon, and means for making tight joints between the adjoining edges of said floor slabs.

6. In a road construction, the combination of parallel rows of firmly mounted floor-supporting members longitudinal of the roadway—each row of said floor supporting members comprising a series of consecutive girders, each of which has a supporting post constructed integrally with and depending from one of its ends and means at the top portion of said post for supporting and maintaining in lateral position the end of the next consecutive girder thereto; floor slabs cross-wise of and resting upon the top

surfaces of said floor-supporting members; means for securing one end of each of said floor slabs to one of said floor-supporting members so as to prevent the movement of said floor slabs cross-wise of said floor-supporting member—the other or unsecured ends of said floor slabs resting at or near their ends upon the top surface of another of the floor-supporting members and being free to move thereon; means for making tight joints between the adjoining edges of said floor slabs, and a curb at either or both margins of the driveway—said curb being constructed integrally with the outer ends of the floor slabs and rising above the traffic surface thereof to form a barrier to prevent vehicles from running off from the driveway.

7. A load-carrying structure comprising a series of consecutive girders, free to move in expanding and contracting, and supporting posts depending from and constructed rigidly and integrally with one end of each of said girders—said posts being adapted at their tops to support and maintain in lateral position not only the ends of the girders of which they form an integral part but also the postless ends of the next consecutive girders thereto.

In testimony whereof we affix our signatures in the presence of two witnesses.

HERBERT B. GILLETTE.
DWIGHT S. COLE.

Witnesses:
ESTHER F. ROSE,
RUTH H. JOHNSON.