J. N. D. BROWN.

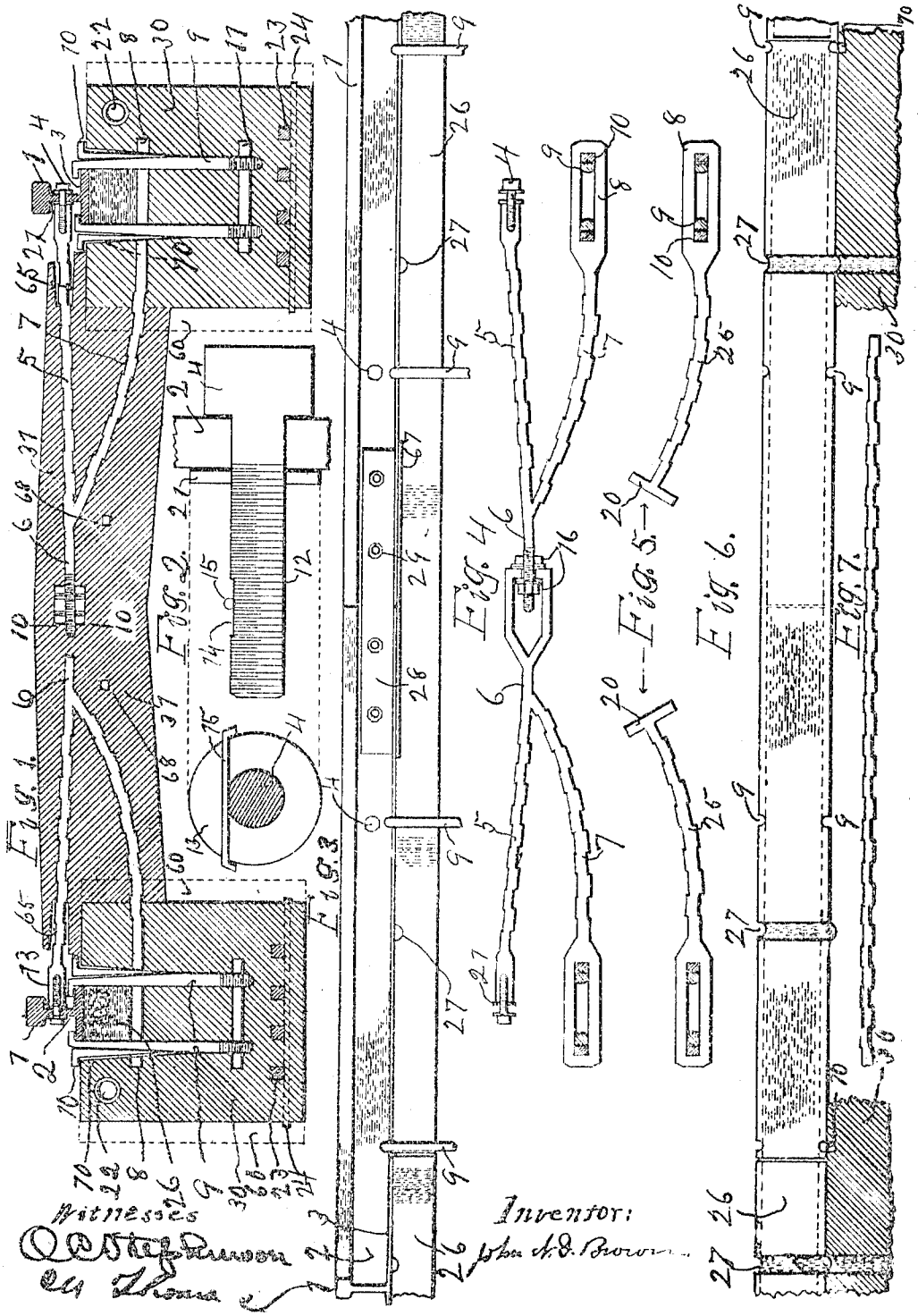
RAILWAY ROAD BED, TRACK AND RAIL CONSTRUCTION.

APPLICATION FILED OCT. 17, 1911.

1,013,736.

Patented Jan. 2, 1912.

4 SHEETS—SHEET 1.



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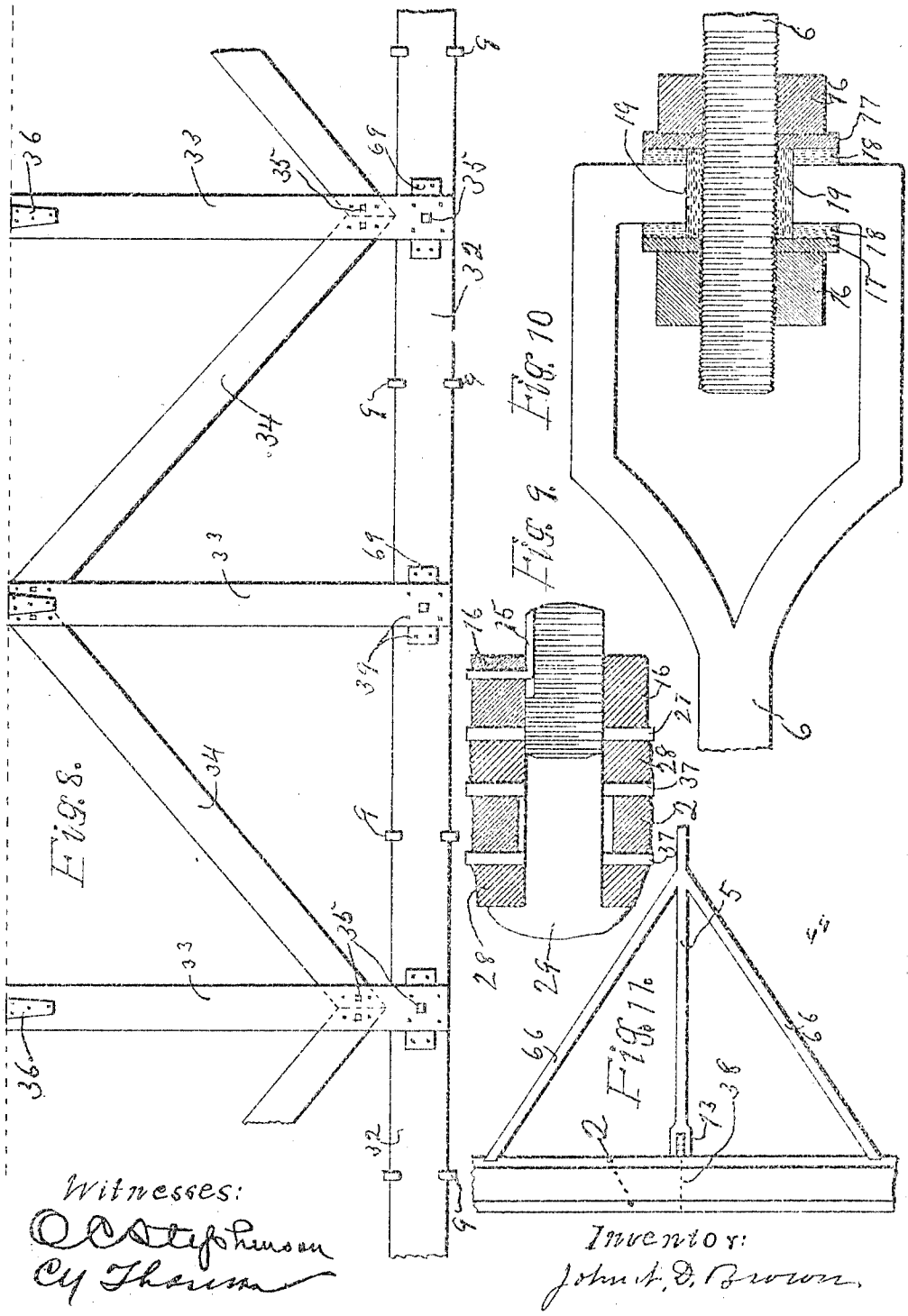

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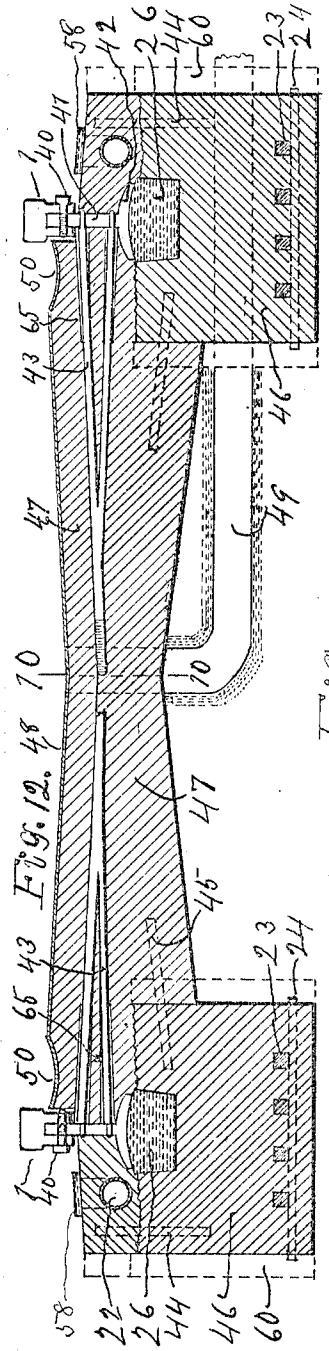

Fig. 12.

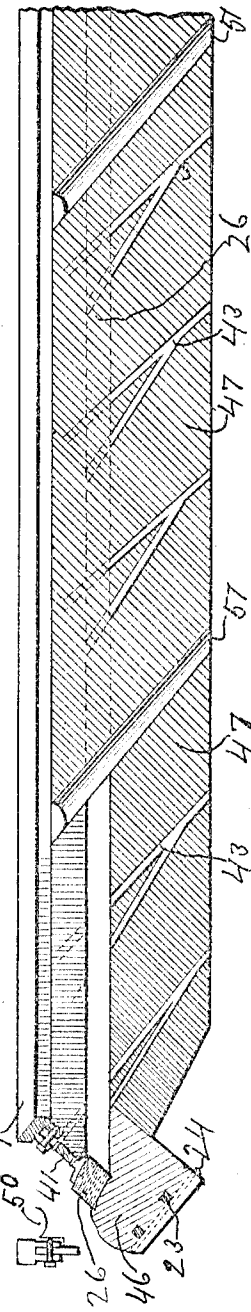

Fig. 13.

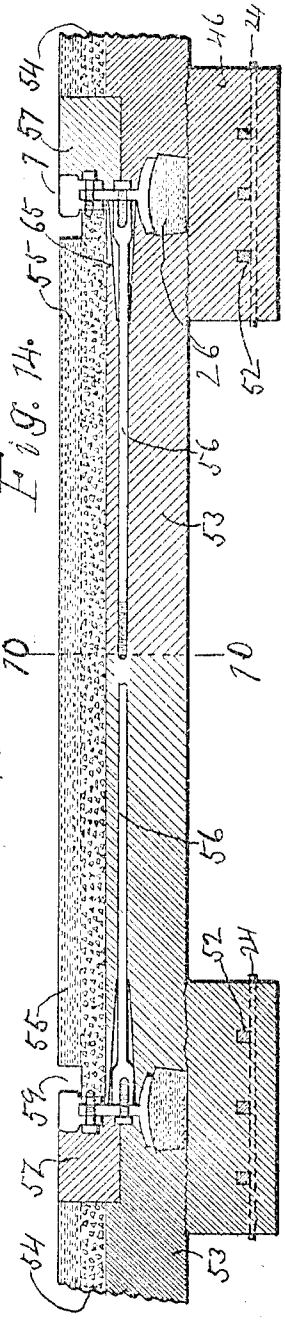

Fig. 14.

Witnesses:

C. C. Johnson

C. J. Thomas

Inventor.

John N. D. Brown

J. N. D. BROWN.

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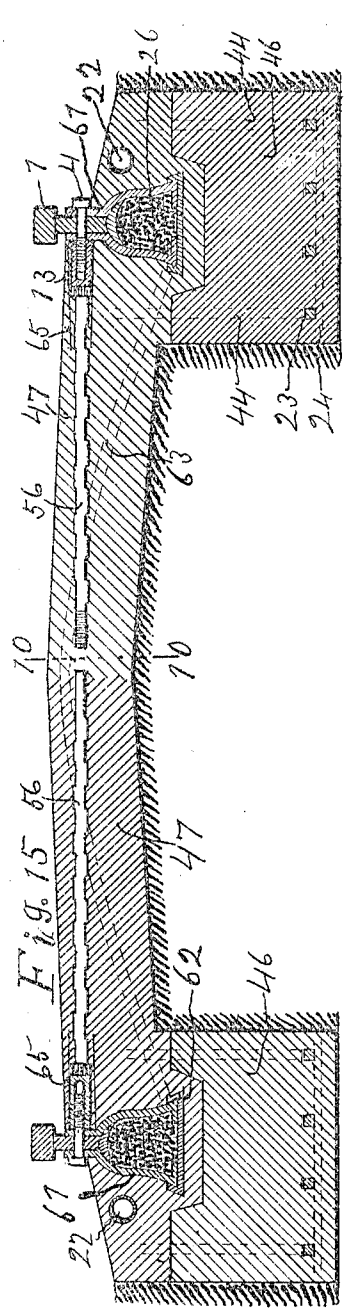

Fig. 15.

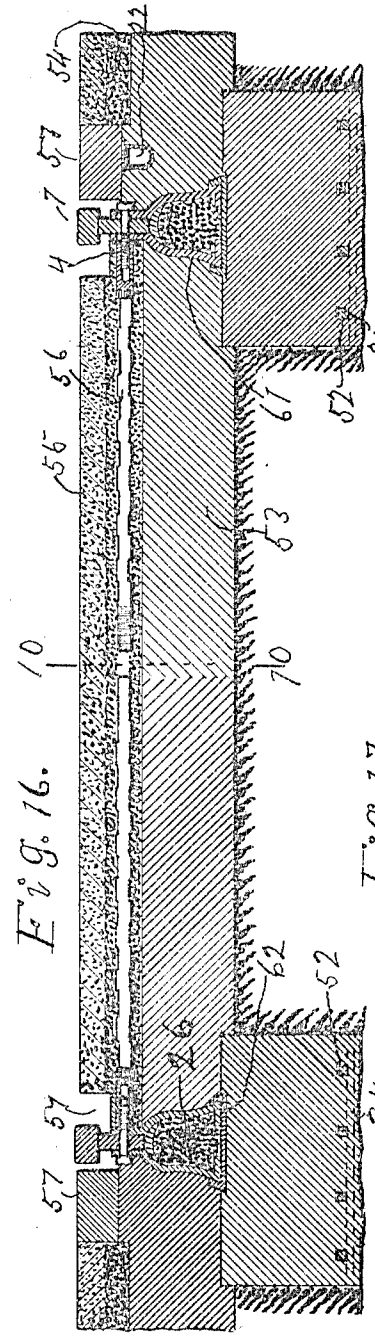

Fig. 16.

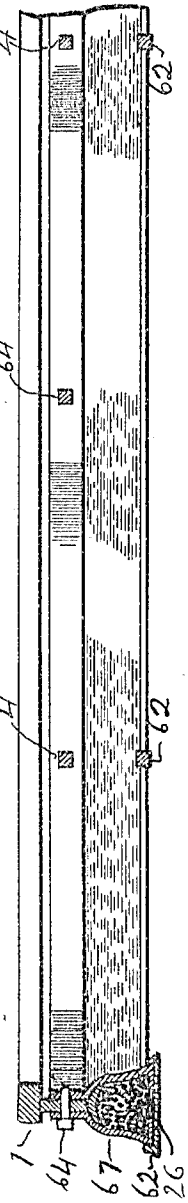

Fig. 17.

Witnesses:

Inventor:

John N. D. Brown

UNITED STATES PATENT OFFICE.

JOHN N. D. BROWN, OF ANADARKO, OKLAHOMA.

RAILWAY ROAD-BED, TRACK, AND RAIL CONSTRUCTION.

1,013,736. Specification of Letters Patent. Patented Jan. 2, 1912.

Application filed October 17, 1911. Serial No. 655,171.

To all whom it may concern:

Be it known that I, JOHN N. D. BROWN, a citizen of the United States, residing at Anadarko, in the county of Caddo and State of Oklahoma, have invented certain new and useful Improvements in Railway Road-Bed, Track, and Rail Construction, of which the following is a specification.

My invention relates to improvements in railway road-bed, track and rail construction; and the object of the invention is to simplify, improve and cheapen proposed methods of steel-reinforced-concrete road-bed, track and rail construction; to eliminate all wood ties and telegraph or telephone poles and to reduce the quantity of concrete and steel required in such a construction to a minimum; to provide a construction in which the entire supporting power of the earth road-bed is utilized, and means provided by which the rail can be removed and replaced when damaged or worn without disturbing any other part of the construction; to provide the resiliency necessary in a safe construction, and at the same time provide for compression, contraction and expansion; to provide a durable and permanent structure in which the danger of broken or spreading rails is practically eliminated; to adapt my constructions to use with the track circuit block signal system by the use of nonconducting materials, all of which I have electrically tested, and a mica insulated connection for the tie and reinforcing rods which laterally connect the opposing rails.

I claim to have provided a better and more reliable track circuit (under all weather conditions) for use with the block signal system than is furnished by the wood ties; a permanent construction, though at materially increased cost, yet if the increase is left to be met by future generations, they will at least have the satisfaction of paying for something of value to themselves.

I show and describe, first, the construction that uses the present form of rail and in which the rail-cushion can be changed; while the other construction shown and described requires a modified form of rail and more steel than the first construction.

Figure 1 shows a vertical cross-section of road-bed, track and rail construction. Fig. 2 represents a sectional view of tie-rod bolt showing the flat place in the threaded end where the wire-nut-lock crosses, while the left part of the figure shows a section across the enlarged end of tie-rod with the nut-lock-wire in position. Fig. 3 shows the rail and cushion in elevation with the concrete left out of view. Fig. 4 shows the construction of the combined tie-rod and reinforcing bars with their anchor-bolt links. The anchor-links and the insulated rod-coupling in the center should lie horizontal and not vertical as shown. Fig. 5 represents the non-connected anchor-bolt links and reinforcing bars connected to the same. The link should be horizontal and not vertical as shown. Fig. 6 shows the top of the cushion and part of the concrete outside of the same, with the half-circle notches in the sides of the cushion where the anchor-bolts come and the curved drainage channels across the top connected with similar channels across the concrete. Fig. 7 shows the pattern of steel reinforcing bars, recommended. Fig. 8 shows one-half of a section of the frame to be used in locating the anchor-bolts in the exact position required to engage the rail-bases. Fig. 9 represents a section of fish-plate bolt with the U shaped slot in the threaded end of the bolt and the wire-nut-lock in position; also, the copper washers used between the fish plate and the web of the rail to furnish a better electrical connection and avoid the use of the usual wire connection; also, the compressible lead washer used to aid in getting the hole in the nut and the U shaped slot in the bolt in line and register. Fig. 10 is a horizontal section through the center of the insulated stirrup rod-coupling. This figure shows the arrangement of the molded mica insulation at 18 and 19 with the steel washers 17 between the insulation and the nuts 16. Fig. 11 shows the reinforcing-rod braces connected with the tie-rod placed at the lineal center of the rails and intended to prevent "creeping" of the rails. Fig. 12 shows a modified construction requiring a special form of rail. This figure, like Fig. 1, shows a vertical cross-section of road-bed, track and rail construction. Fig. 13 is a reduced lineal view of the construction shown in Fig. 12, only one-half of the width is shown. Fig. 14 shows Fig. 12 modified and adapted to use as a street railway when streets are paved with any material having a concrete base. Fig. 15 represents another modified construction having the cushion inclosed within a rail-shoe consisting of curved steel plates. This figure, like Fig. 1, shows a ver-

tical cross-section of road-bed, track and rail construction. Fig. 16 shows Fig. 15 modified and adapted to street railway construction when the streets are paved with any material having a concrete base. Fig. 17 shows the rail and rail-shoe in elevation.

Like numerals represent like parts.

1 is the head of the rail; 2 is the web of the rail and 3 is the base of the rail.

4 is a tie rod-bolt.

5 is the tie rod.

6 represents the combined tie-rod and anchor-link reinforcing bars.

7 is the anchor-link reinforcing bar.

8 is the anchor-link.

9 represents the anchor-bolts.

10 represents the anchor-keys and 11 the anchor-plates into the threaded holes of which the anchors screw.

12 represents the threaded end of tie-rod bolt.

13 represents the enlarged ends of tie-rods.

14 represents a flat place across the threaded end of a bolt and is designed to be engaged by a nut-lock-wire to prevent the bolt nut from working loose.

15 represents the nut-lock-wire in position.

16 represents a nut and 17 a steel washer.

18 represents molded mica insulation washers.

19 represents a molded mica thimble around the bolt.

20 shows how the end of non-connected reinforcing bar 7 should be formed—it should lie horizontal, not vertical as shown.

21 represents a compressible lead washer used at this point to prevent the expansion and contraction of the rail breaking the bolt.

22 represents conduits for wires used in railway operation.

23 represents three-quarters of an inch lineal reinforcing bars.

24 represents three-eighths of an inch lateral reinforcing bars.

25 is the three-quarters of an inch square reinforcing bar of the non-connected anchor-links.

26 represents a cushion of materials hereinafter specified.

27 represents drainage channels across the top of the cushion and under the rail-base.

28 represents an ordinary fish-plate and 29 the fish-plate bolt.

30 represents the steel-reinforced concrete rail-bases.

31 represents the central concrete between the rails.

32 represents parallel strips of the width of the bases of the rails to be used.

33 represents the lateral cross ties of the frame: they are hinged together in the center to facilitate moving forward.

34 represents braces, 35 bolts and 36 hinges.

37 represents copper washers used in place of wire connections to convey the current from abutting rail to abutting rail by means of the fish-plates.

38 represents the lineal center of the rail.

39 represents nails or screws.

In Figs. 12, 13 and 14:—40 represents the bolts or rivets securing the rail to the upright arm of rail-chair. 41 represents the upright arms of rail-chair. 42 represents the curved base of rail-chair. 43 represents the lateral reinforcing and tie-rods. 44 represents five-eighths of an inch vertical reinforcing bars. 45 represents five eighths of an inch horizontal reinforcing bars. 46 is the primary concrete of rail-bases. 47 is the secondary concrete outside of and between the rails. 48 represents a finishing coat of sand and Portland cement. 49 represents a drain composed of sheet iron incased in concrete. 50 represents lineal drainage channels. 51 represents lateral drainage channels to center of track. 52 represents five-eighths of an inch square reinforcing bars. 53 represents the ordinary concrete base of street paving. 54 represents a coat of small crushed stone and asphalt. 55 represents the finishing coat of asphalt paving. 56 represents a three-quarters of an inch tie-rod. 57 represents a row of paving brick placed along the outside of the rail.—58 is the cover of manhole to conduit. 59 represents the space left for flanges of wheels. 60 represents the planks composing the form used to mold the concrete rail-base.

In Figs. 15, 16 and 17: 61 represents the curved steel plates forming the rail-shoe. 62 represents the metal strip or clamp that holds the curved plates together. 63 represents five-eighths of an inch steel reinforcing bars. 64 represents the bolts that come between the tie-rod bolts. 65 represents sheet iron or steel tubes placed around the ends of tie-rods to keep the concrete away at that point to allow for compression of cushion and the contraction and expansion of the rails. 66 represents reinforcing braces placed at the lineal center of the rails (in Fig. 1) and welded to tie-rod to prevent "creeping" of the rails. 67 represents a three-eighths of an inch steel plate two feet long placed under the abutting ends of the rails. 68 represents three-eighths of an inch lineal reinforcing bars. 69 shows the half-inch blocks placed between members 32 and 33 of Fig. 8. The purpose of these blocks is to lower the top of member 32 a half-inch below the top of the planks forming the concrete rail-base form, so that when the anchor-bolts are turned up to receive the cushion, there will be a hole in the concrete below the end of the bolts so that they can be screwed down, if necessary. 70 represents a prepared paper or wood protec-

tion, one-eighth of an inch thick, placed around the outside and contiguous sides of anchor-keys and anchor-bolts and extending down to the anchor-link 8, only; the purpose of this is to keep the concrete away from this part of the keys and bolts. This protection should be removed when the concrete has set. After the construction is complete, the space around the anchor-bolts and anchor-keys should be filled with liquid asphalt.

I provide and specify that a good job of concreting shall be done; that good, hard crushed rock, not larger than two inches in diameter, be used; that the sand be clean and sharp and the Portland cement of good quality and in live condition; that all upper and exposed parts be smooth with no rock showing; when setting the cushion, that it be embedded in liquid cement (Portland and sand).

The lineal reinforcing bars 23 and 68 should be two inches less in length than the rails to be used and should be laid with the ends laterally in line; this would leave the abutting ends two inches apart which distance must not be less. The lineal reinforcing bars placed in this way would form sections of concrete of rail lengths. The ends of the sections should come near, but not at, the lineal centers of the rails. The sections should be joined by short pieces of reinforcing bars placed not closer than two inches to any other metal.

The anchor-plates 11, should be placed two inches above the lineal reinforcing bars 23, and not closer. The anchor-bolts 9, should be formed from three-quarters of an inch round iron or soft steel with lower ends threaded as shown, and, commencing above the threaded part, flattened wedge shape and turned at the top from the flattened side, as shown. The length of the anchor-bolts should be such that when in position clamping the rails to the concrete rail-bases, the lower end will not extend more than one-quarter of an inch below the anchor-plate 11.

The anchor-keys 10, should be made of three-quarters of an inch square iron or soft steel with lower ends shaped as a wedge and the upper ends turned as shown.

The anchor-links 8, should be formed from three-quarters of an inch square steel with the inside length the width of the base of the rail to be used plus the size of the two anchors and anchor-keys where they pass through it. The ends on the inside should be formed with square angles as shown. These anchor-links should be either formed from reinforcing bars 7 and 25 or welded thereto. Member 20 is welded to bar 25 and it and the link should lie horizontal and not vertical as shown.

The stirrup of the insulated adjusting rod-coupling (see Fig. 10) should be five-eighths of an inch thick and not less than two inches wide where the threaded end of rod 6 passes through it. The sides of the stirrup may be three-eighths of an inch thick and, in width, eased down to three-quarters of an inch where they join and are welded to bar 6 on the left. The bolt hole in the right-hand end of the stirrup must be five-sixteenths of an inch larger than the threaded end of rod 6 as the insulating thimble 19 which goes around said rod is one-eighth of an inch thick. The threaded end of rod 6 should pass loosely through the thimble.

The tie-rod bolt 4 should be made, as shown in Fig. 2, with a flat place in the threaded end about one-half of an inch long and double the depth of that to which the threads are cut. The enlarged ends 13, of the tie-rod 5 that receive the bolt, should have a lateral hole through one side of the same corresponding to the flat place on its bolt, as shown at the left end of Fig. 2. The purpose of the flat place on the bolt and the hole in the enlarged end of the rod is to receive the nut-lock-wire 15 which is designed to prevent the bolt working loose.

Reinforcing bars 7 are welded to reinforcing bars 5 as shown, and these bars 7 and 5 when united, form rods 6. Rods 6 are joined by the insulated adjusting stirrup rod-coupling shown as Fig. 10 and all combined and united form a single part of the construction and must be so standardized or manufactured that, by the use of compressible lead washers, one-eighth of an inch thick, between the ends of the tie-rods and the webs of the rails, the rails will be in gage and the anchor bolts 9 will stand perpendicular. If the ends of the tie-rods and the anchor-links 8 are constructed with the proper relation to each other, the slight variations of gage can be adjusted by the nuts on rod 6 of the stirrup coupling.

I would place the combined tie-rods and anchor-links from six feet to eight feet apart on straight track and much closer on the curves—say four feet on a three degree curve. I would place the non-connected anchor-links and reinforcing bars between the connected ones so the rails will be anchored at least every two feet.

The holes near the ends of the rails for the fish-plate bolts should be sufficiently large or elongated to allow for all probable expansion or contraction. The holes in the webs of the rails for the tie-rod bolts 4 should be one-sixteenth of an inch larger than the bolts. If the reinforcing braces shown in Fig. 11 are used at the lineal centers of the rails there can be little "creeping" of rails. The spring of the ends of tie-rods will allow for all probable compression of cushion and expansion and contraction of rails. Note, that a sheet metal

tube 65 is shown and specified to go around the ends of tie-rods, near the rails, to keep the concrete free from the rods at these points and permit them to spring down or to the side.

To locate the anchor-bolts and anchor-keys quickly and unerringly, I provide and have shown in Fig. 8 parts of a wood frame or form to be used. I show only one-half of the width and a small part of the length. It would be best of full rail length. The lineal parallel pieces 32 should be of the exact width of the bases of the rails to be used and be connected by the lateral members 33 so as to be of the proper gage. The lateral pieces 33 are cut into at the exact center of the same and there hinged together to facilitate moving forward. A shim of wood a half inch thick is placed between members 32 and 33 to drop the anchor-bolts one-half inch lower than they would be if resting on the cushion. Place the center of the frame, where hinged together, in line with the tacks in the center stakes of earth road-bed and the lateral ties 33 on top of the inner planks of concrete rail-base forms and locate the anchor-bolts as shown at 9 and to correspond, lineally, with the tie-rod bolt holes in the webs of the rails to be used, and you cannot, reasonably, get wrong.

For fish-plate bolts I would use a bolt with a lineal U shaped slot in the threaded end of the same and a nut with a hole in one side extending into the threaded center, all adapted to the use of a nut-lock-wire, as shown in Fig. 9. I would place copper washers one-eighth of an inch thick between the fish-plates and the web of the rail and see that the rails and fish-plates are smooth and free from rust at the places that come in contact with the copper washers. A compressible lead washer is placed under the head of the fish-plate bolt and not under the nut, as shown in Fig. 9.

To install the construction shown in Fig. 1, I provide that the parallel trenches required, be dug ten to fifteen inches deep according to the character of earth road-bed and the requirements of the construction; that the bottom of the trenches be well tamped, and, if the road-bed is soft and spongy, that the trenches be dug deeper and the deeper part filled-in with dry clay or broken stone; that when so dug planks of the proper width be provided in sufficient quantity for one day's construction; that half inch holes bored in the planks one-half inch deep and one and one-half inches from the bottom of the same, and at intervals of four feet; that reinforcing bars 24 be cut to seventeen inch lengths, and placed in the above described holes, after the planks are set in the trenches, and that earth be packed against the bottom of the planks on the outside. The planks provided for the inside of the trenches should be in two widths, one to come up to the bottom of reinforcing bars 7 and 25, and the other to complete the width, same as the outside planks; notches in the upper piece fit over bars 7 and 25. Place braces cut to sixteen inch lengths between the opposing planks, about two inches below the top of the same and out of the way of the anchor bolts. If the planks are wired together, the wires must come below the cushion and not nearer than two inches to any other metal part of the construction. Line and level up the forms thus made to correspond to grade of earth road-bed and gage of rails. Place the wood frame provided for locating the anchor-bolts in position and place the combined tie-rods and link reinforcing rods in position as shown in Fig. 1 with the non-connected links and reinforcing bars located between the connected ones as provided. Give that part of the anchor-bolts and anchor-keys that extends below the anchor-links a coat of melted paraffin or some kind of paint to keep the concrete from adhering to the same and place the one-eighth of an inch protection 70 around the anchor-bolts and keys above the anchor-links—remove this after the concrete has set and preserve for further use. Proceed to fill the forms with concrete (crushed rock, sand and Portland cement) wet enough for a little water to rise to the top; fill up near the bottom of cushion and let it set sufficiently so that the anchor bolts can be turned up without disturbing the anchor-plates, but do not wait for it to harden or take its final set. Turn up the anchor-bolts sufficiently to pass over the cushion and remove the frame and carry it forward to locate additional anchor-bolts. Place the cushion or, preferably, a form for the same, and complete the concrete rail-bases after first placing the conduits 22 in position. When the concrete has set, remove the planks and carry forward for additional use. Place the cushions if they were not placed when finishing the concrete. Use only thin liquid cement to embed them in. Locate the steel plates 67 that go under the abutting ends of the rails; these plates should only come flush with the top of the cushion. Place the rails on the cushions, adjusting the gage by means of the nuts on rod 6; screw down the anchor-bolts; place the fish-plates with the copper washers 37 between them and the webs of the rails and the compressible lead washers under the heads of the fish-plate bolts, turn the nuts up snugly and insert the nut-lock-wire 15; if the hole in the nut and the slot in the bolt do not register, tap the head of the bolt smartly while you are trying to turn the nut forward to register and when in register insert the nut-lock-wire as above.

Lay the central concrete by the use of the construction train. Have a concrete mixer on the end of a flat car and materials convenient to the same. Trowel or float the surface of the concrete up smooth and see that all crushed stone is below the surface. The adjustable insulated stirrup rod-coupling connecting rods 6 should be incased in the central concrete without any protection. Good concrete is a non-conductor.

All directions and specifications as to the installation should be strictly followed, if a good and reliable track circuit for the block signal is desired. Metal parts with less than two inches of concrete between them might shunt off a part of the current.

At the ends of the blocks, I would insulate the abutting ends of the rails by using the best mica insulating cloth between the fish-plates and the rails and the molded mica washers and thimble shown in Fig. 10 around the fish-plate bolts in place of the copper washer provided for the other abutting rail connections.

To install the modified construction shown by Fig. 12, I provide that all things specified for Fig. 1 and applicable to this modified construction, be followed. In this construction there is a special form of rail with the web cut away and the lower part of the head elongated, by the use of additional metal, and a groove in the same that fits over the upright arm of a continuous rail-chair and is bolted or riveted thereto. The upright arm is united to and supported by a curved base which rests upon a cushion embedded in what I call primary concrete 46. The opposing rail-chairs are united and held in gage by combined lateral reinforcing tie-rods. These rods are shown plain but should be three-quarters of an inch square steel reinforcing bars except at the inner ends where they are connected by the adjusting insulated stirrup rod-coupling shown in Fig. 10. The reinforcing and tie-rods 43 pass through holes in the arms of rail-chairs and are riveted thereto, as shown. No metal; other than these rods and the sheet iron tubes 65 around the ends of the same, which tubes should be sufficiently large at the rail-chair ends to permit the rods or reinforcing bars to move down and to the side, in case of compression of the cushion or unequal expansion and contraction of rail and rail-chairs; should come closer than two inches to the rail or rail-chairs or their metal connections. The rail-chairs and the rails of this modified construction should be in two lengths; if one is 30 ft., the other should be 40 ft.; the center of the 30 ft. rail should be at the center of the 40 ft. rail-chair and the center of the 40 ft. rail at the center of the 30 ft. rail-chair; this would form, practically, a continuous rail. The bolt or rivet holes in the rail-chair should be sufficiently elongated from the center of the rail-chairs toward the ends to allow for unequal expansion of rail and rail-chairs. At the ends of signal blocks, the ends of the rails and rail-chairs should coincide and the upright arms of rail-chairs should be connected by a steel plate placed on either side and bolted thereto and insulated as shown in Fig. 1. All the concrete above the top of cushion 26 and that between the rails is known as secondary concrete and would be laid from the construction train. To install this first modified construction, proceed in a similar manner as in the first construction until the cushion is placed, not neglecting to place the shorter reinforcing bars 44 and 45; then set the rail-chairs on the cushion; place the sheet iron tubes 65 around bars 43 and insert the ends of the bars in the rivet holes in the arms of rail-chairs and rivet the same thereto; place the rails on the upright arms of rail-chairs and bolt or rivet the same thereto; if rivets are used they should be only slightly hammered down so that they could be readily punched out should a change of rails, from any cause, be required. Adjust the gage of rails by the nuts on the ends of the tie-rods. Place the conduits as shown and form the lineal and the lateral drainage channels same. The rail-chairs must have a heavy coat of asphalt paint, applied hot, before the secondary concrete is laid. Provide for disposing of the drainage water, collected in the center of the track, by placing metal tubes 49, made of thin sheet iron, at suitable intervals and incase the same in concrete as shown.

Install the modified form of construction shown in Fig. 14 as the drawing and description of the same would indicate; reference being had to provisions for the installation of the modification shown in Fig. 12.

In the second modified construction, as shown by Fig. 15, we have a concrete construction similar to that shown in Fig. 12 except that the draftsman neglected to provide for drainage. I would specify that the concrete at the rails be brought up within one-half inch of the head of the rail and lineal drainage channels formed as in Fig. 12; and that these lineal channels be connected, at suitable intervals, by lateral channels and that the drainage water be disposed of through sheet metal drainage pipe incased in concrete as shown in Fig. 12. In this construction we have another special form of rail with the base cut away and formed into a curved, continuous cap upon which the web of rail rests and which curved cap rests upon a cushion inclosed within a rail-shoe composed of two curved steel plates 61 connected at the bottom by the metal cleats 62 and having the web of the rail bolted between the vertical parts of

the curved steel plates. The tie-rod 56 used in this construction should be connected in the center by the insulated adjusting stirrup rod-coupling shown in Fig. 10. These tie-rods should be placed at reasonable intervals and bolts, similar to those shown at 40 in Fig. 12 used between the tie-rod bolts 4 at intervals of near two feet. The bolt holes in the web of the rail should be larger than the bolts to allow for compression, contraction and expansion. Install in a manner similar to that provided for the other constructions,

Fig. 16 represents this last modified principal construction adapted to street railway construction when the streets are paved with any material having a concrete base. I would install this street railway construction in a manner similar to that provided for the other constructions.

The cushion 26 may be composed of the following materials:—The cushion for Fig. 1 where the present form of rail is used, would be more exposed to changes of temperature than the cushions in the other constructions and should be composed:

First: Of light, porous wood free from knots or hard pitchy spots and should be first kiln dried and then immersed in crude oil or oil residuum of an asphalt base, while hot. It should be boiled in the oil or residuum or the same should be forced into the cells of the wood by pressure. A cushion thus prepared would last indefinitely, at least more than twice as long as the average tie as now treated.

Second: The best rock asphalt 25%, crude oil of an asphalt base 3%, sand 45%, Portland cement 22% and fine dry sawdust 5%. Add the oil to the asphalt and heat the same until the asphalt is melted, then add the other ingredients. Keep very hot and mix thoroughly. Press, under heavy pressure, into a mold of the proper shape while hot. Place paper in the mold so that the cushion can be turned out or have a mold that can be opened.

Third: Asphalt 20%, crude oil of an asphalt base 2%, gasolene 10%, sand 40%, Portland cement 18% and sawdust (fine and dry) 10%. This last composition of materials is prepared cold. Break the rock asphalt into small pieces about the size of grains of corn or smaller, add the oil and gasolene and after standing some ten or twelve hours agitate until you have a smooth mixture with all the asphalt dissolved. Now add the other ingredients specified and mix all thoroughly. Let the completed mixture stand until the larger part of the gasolene has evaporated, but not till too dry to adhere together firmly under pressure. When in the proper condition press under heavy pressure in a mold of the proper form.

The asphalt mixtures should last indefinitely and would, for years at least, provide greater resiliency than the wood cushion. The purpose of the Portland cement is to toughen the mixture, it does not harden it. The purpose of the sawdust is to add to the resiliency particularly in cold weather and in hot weather to absorb the lighter or oily particles of the asphalt and retard its softening tendency when exposed to heat.

For the cushions in the modified construction, a cushion substantially the same as the finishing coat of the best asphalt paving may be used, or preferably, the third composition as above.

I provide and claim the right to change the width, depth and thickness of the concrete; the size of the steel reinforcing bars and the intervals at which they are placed; the size and weight of the rails; the thickness of the steel plates used and their form and size; the size of the bolts, their length and form; the diameter of conduits; the percentages of the different materials used in the cushions; and any other matters necessary to adapt my constructions to the requirements of different railways and differing local conditions.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A railway road-bed, track and rail construction in combination with parallel concrete rail-bases steel reinforced near the bottom of same by parallel lineal reinforcing bars wired to short lateral bars, and near the top by conduits, and at the top by rails securely anchored thereto; steel reinforced laterally by short reinforcing bars placed near the bottom of the rail-bases, by anchor-plates, and anchor-links with steel reinforcing bars attached to the same; reinforced and bound together vertically by anchors securing the rails to the concrete bases; as shown and specified.

2. A rail-way road-bed, track and rail construction in combination with concrete rail-bases, of the character shown, specified and claimed, united and bound together laterally by continuous concrete extending between the rail-bases near the top of the same; said central concrete steel reinforced lineally by parallel reinforcing bars and laterally by combined tie-rods and connected anchor-link reinforcing rods united at the center of track by an adjusting stirrup rod-coupling; as and for the purpose shown and specified.

3. A railway road-bed, track and rail construction in combination with steel reinforced concrete rail-bases, of the kind shown, specified and claimed, with a cushion of resilient material resting upon and within the same and rails of the usual form and pattern resting upon said cushions and

anchored to the same and to said concrete rail-bases by anchor-bolts placed on both sides of the rail bases and extending down through an anchor-link and screwing into an anchor-plate placed below the center of said steel reinforced concrete rail-bases; as and for the purpose shown and specified.

4. A railway road-bed, track and rail construction in combination with a steel reinforced concrete road-bed, of the character shown, specified and claimed, with continuous cushions and rails of a common form in combination therewith; said opposing rails being laterally connected by steel reinforcing bars and tie-rods having an insulated, adjusting stirrup rod-coupling connecting the same at the center of the track; said rod-coupling being in the form of a stirrup with the approaching sides joined and welded to the inner end of the tie-rod, and the other end of said stirrup having a hole in the widest part and a molded mica thimble placed in said hole and the opposing threaded end of tie-rod passing through said insulating thimble with molded mica washers around said threaded end of the tie-rod and fitting over the ends of said mica thimble, with steel washers and nuts on said tie-rod, placed at both ends of the said insulating thimble, clamping the insulating washers to the said stirrup rod-coupling; as and for the purpose shown and specified.

5. A railway road-bed, track and rail construction comprising a steel reinforced concrete road-bed, of the class shown, specified and claimed, in combination with anchor plates, with threaded holes in the same, placed within and below the center of the concrete rail-bases; with anchor-links placed within said steel reinforced concrete rail-bases and connected to steel reinforcing bars and tie-rods by steel reinforcing bars united to said anchor-links and to said reinforcing bars and tie-rods; with non-connected anchor-links with upward curving reinforcing bars, having T shaped upper ends, united to said anchor-links and provided and used to place between said connected anchor-links to furnish additional anchorage for the rails; with anchor bolts of round iron with lower ends threaded to screw into anchor-plates and upper ends flattened and turned at an angle to engage the rail-bases; with anchor-bolts engaging the rail-bases and extending down into the concrete rail-bases, passing through the anchor-links and screwing into the anchor-plates, thus clamping the rails to the concrete rail-bases; with anchor-keys of a wedge shape placed on the outside of the anchor-bolts and against the flat side of the same and extending down through the anchor-links and by means of this wedge shape and the anchor-links holding the anchor-bolts snugly to the base of the rail and preventing them from turning therefrom; as and for the purpose shown and specified.

6. A railway road-bed, track and rail construction comprising parallel-steel-reinforced concrete rail-bases shown; with cushions of a resilient material embedded, continuously, within and upon the said concrete rail-bases; said cushions having half-circle drainage channels, placed at suitable intervals, across the top of the same and connecting with half-circle drainage channels across the concrete outside of the rails; as and for the purpose shown and specified.

7. A railway road-bed, track and rail construction comprising parallel-steel-reinforced concrete rail-bases shown, in combination with continuous semi-resilient wood cushions supported within and upon said concrete rail-bases; said wood cushions having suitable drainage channels, placed at reasonable intervals, across the top of the same and connecting with similar drainage channels placed across the top of the concrete which extends, lineally, outside of the rails; as and for the purpose shown and specified.

8. A railway road-bed, track and rail construction comprising concrete rail-bases shown, in combination with resilient cushions placed within and upon said concrete rail-bases and continuous therewith; said cushions so provided, placed and used for the purpose of furnishing necessary resiliency for the steel rails; as and for the purpose shown and specified.

9. A railway road-bed, track and rail constructions comprising parallel concrete rail-bases steel reinforced, lineally, near the bottom of the same, said concrete rail-bases reinforced and strengthened, lineally, at the top by rails of a usual form resting upon resilient cushions which are placed within and upon said concrete rail-bases and flush with the top of the same; said rails being securely anchored on said cushions and to said concrete rail-bases; said concrete rail-bases being steel reinforced laterally, near the bottom of the same, by short steel reinforcing bases, below the center of the same, by anchor-plates and, under the cushions carried by said concrete rail-bases, by anchor-links; all so placed and used to strengthen the said concrete rail-bases laterally and prevent the lineal cracking and splitting of the same; said concrete rail-bases are further strengthened both lineally and laterally by a body of steel reinforced concrete extending, continuously, between the rails and secured to and united with said concrete rail-bases by steel reinforcing bars anchored to said concrete rail-bases and extending, laterally, into said central concrete and anchored therein and thereto by a T shaped inner end thus strengthening the entire con-

crete road-bed against the lateral shearing strain of heavy traffic when rounding sharp curves; and for the purpose shown and specified.

10. A railway road-bed, track and rail construction comprising parallel steel reinforced concrete rail-bases, of the class shown, specified and claimed, in combination with a cushion of resilient material having rails of a usual form resting upon said cushion; the abutting ends of said rails resting upon a steel plate of suitable length placed flush with the top of said cushion; the abutting ends of the rails joined by fish-plates of a pattern similar to those in general use and secured to the rails by fish-plate bolts having U shaped slots in the threaded ends of the same and accompanying nuts with a hole in one side of the same and extending into the center threads of the nut and a nut-lock-wire thereto belonging and designed to enter the hole in the side of the nut, and follow the slot in the bolt, thus locking the nut on the bolt; said fish-plate bolts are provided with copper washers to be placed between the fish-plates and the web of the rails and a compressible lead washer to go under the head of the bolt to aid in getting the hole in the nut and the slot in the bolt in line and register so that the nut-lock-wire will enter; as and for the purpose shown and specified.

11. A railway road-bed, track and rail construction comprising parallel steel reinforced concrete rail-bases, of the class shown, specified and claimed, in combination with rails of a usual pattern united and held in gage by combined reinforcing and tie-rods; said tie-rods secured to the rails by bolts having a flat place in the threaded end of the same designed to be engaged by a nut-lock-wire passing through a lateral hole in the enlarged end of tie-rod; said bolt is provided with a compressible lead washer to place between the enlarged end of tie-rod and the web of the rail to aid in getting the flat place on the bolt and the hole in the end of tie-rod in line and register, also to prevent the expansion and contraction of the rail breaking the bolt when turned snugly up; as and for the purpose shown and specified.

12. A railway road-bed, track and rail construction in combination with steel reinforced concrete rail-bases of the class shown, specified and claimed, with cushions of resilient material resting upon and within said rail-bases; rails of a usual form and pattern resting on said resilient cushions and secured thereto and to the concrete rail-bases by anchor-bolts so constructed, placed and arranged that, by removing the wedge shaped anchor-keys and turning the anchor-bolts a quarter turn, the rails and cushions are released and can be removed and replaced, whenever so desired, without disturbing or injuring any other part of the construction; as and for the purpose shown and specified.

13. A railway road-bed, track and rail construction comprising steel reinforced concrete rail-bases, of the class claimed, shown and specified, in combination with resilient cushions embedded in and upon said rail-bases; with rails of a usual form and pattern resting upon said cushions and securely anchored thereto and to said concrete rail-bases of said anchor-bolts, with a frame provided for unerringly locating said anchor-bolts; said frame consisting of wood strips, of the width of the bases of the rails to be used, placed and secured parallel and of the proper gage and held in gage by lateral strips bolted and nailed thereto, with a shim of wood one-half inch thick placed between the lineal and lateral strips; braced and held straight by angle braces extending from the lineal to the lateral wood strips; said lateral strips cut into at their exact centers and hinged together; said wood frame to be placed and used as and for the purpose specified.

14. The combination in a railway road-bed and track construction of parallel steel-reinforced-concrete stringers; called primary concrete, united and connected by a secondary coat of steel-reinforced concrete extending, and covering the surface of earth road-bed between the rails, and having steel-reinforcing bars placed across said stringers with lineal steel reinforcing bars resting thereon and near the bottom of stringers, and having vertical steel-reinforcing bars placed at intervals to bind the primary and secondary concrete together, and having horizontal steel-reinforcing bars so placed as to bind the concrete stringers to the concrete between the rails; as and for the purpose shown and specified.

15. The combination in a railway road-bed and track construction of parallel steel-reinforced concrete stringers, called primary concrete, united and connected by a secondary coat of steel-reinforced concrete extending, and covering the surface of earth road-bed, between the rails, and having a cushion of resilient materials embedded in said stringers and continuous therewith, said cushion having resting thereon, a rail-chair having a curved base and an upright arm which carries the rail and to which the rail is bolted or riveted; as and for the purpose shown and specified.

16. The combination in a railway reinforced concrete road-bed of a track construction having parallel continuous rail-chairs connected and held in gage by steel reinforcing bars, with their outer ends passing through the upright arms of said rail-chairs, near the base of same, and near the rail se-

cured thereto, and securely riveted to said upright arms of the rail-chairs; said connecting steel reinforcing bars are united near the center of the track and form opposing rods which are connected at the center of the track by an insulated adjusting stirrup rod-coupling; as and for the purpose shown and specified.

17. The combination in a railway steel reinforced concrete road-bed of a track construction having parallel continuous rail-chairs comprising a curved base and an upright arm which carries a special form of rail in which the base and web of the usual form of rail is cut away and the head narrowed and elongated on the lower side and having a groove therein which fits over the upright arm of the rail-chair and is bolted or riveted thereto; as and for the purpose shown and specified.

18. The combination in a railway road-bed and track construction of concrete strengthened laterally by steel reinforcing bars united in the center of the track and connected by an insulated adjusting rod-coupling and lineally by steel reinforcing bars, rail-chairs and conduits; as and for the purpose shown and specified.

19. The combination in a railway road-bed and track construction of reinforced parallel concrete stringers in connection with the concrete base of street paving; said stringers having a cushion thereon upon which a rail-chair rests; said rail-chair having a curved base and an upright arm with a new form of rail fitted thereon and bolted thereto; having the paving materials brought up flush with the top of the rail, except a place for the flange of wheels, and a row of paving brick so placed as to provide a means of getting at the rail bolts and the manhole cover of conduit; and embedded tie-rods placed at intervals to bind the rail-chairs together and hold the rails in gage; said tie-rods connected in the center of the track by an insulated adjusting rod-coupling; as and for the purpose shown and specified.

20. The combination in a railway road-bed and track construction of parallel steel reinforced concrete stringers called primary concrete, united and connected by a secondary coat of concrete, steel reinforced, extending and covering the surface of the earth road-bed between the rails; said central secondary concrete having lineal drainage channels adjoining the rails; said lineal drainage channels having lateral drainage channels, placed at suitable intervals, to collect the drainage water in the center of the track where it is disposed of through sheet metal pipe, incased in concrete, placed at suitable intervals, extending down and then horizontal to the side of earth road-bed; as and for the purpose shown and specified.

21. The combination in a railway road-bed and track construction of parallel steel-reinforced concrete stringers with a rail-shoe embedded in the same having a vertical part extending above the concrete, a cushion material inclosed in said rail-shoe, a curved steel cap within the rail-shoe resting on said cushion and taking the place of the base of the present form of rail, a rail with the web of same resting on said curved steel base and bolted between the projecting parts of said shoe, and having enlarged bolt holes in the web to provide for compression of cushion and unequal expansion and contraction of rail and rail-shoe, and having metal tie-rods provided at intervals to take the place of bolts and hold the rails in gage; said tie-rods united in the center of the track by insulated adjusting stirrup rod-couplings; as and for the purpose shown and specified.

22. The combination in a railway road-bed and track construction of parallel steel-reinforced-concrete stringers connected by reinforced concrete extending between the rails and having a rail-shoe embedded in the stringers with the vertical part of the outside of same extending above the concrete so that rail bolts and tie-rods can be inserted or removed, a cushion material embedded in the rail-shoe on which the detached curved base of the rail rests and upon which the web of rail rests, the web of rail extending down between the vertical parts of the rail-shoe and having enlarged bolt holes in the same to provide for compression of cushion and for unequal expansion and contraction of rail and rail-shoe, said rail being bolted between the vertical parts of the rail-shoe and having incased metal tie-rods with insulated adjusting stirrup rod-couplings in the center of the same, placed at intervals, in place of said bolts, to hold the rails in gage; as and for the purpose shown and specified.

23. The combination in a railway road-bed, track and rail construction of parallel steel reinforced concrete stringers in combination with ordinary street paving having a concrete base; with a rail-shoe of curved steel plates resting on said stringers and having a cushion of resilient materials within said rail-shoe upon which the detached curved base of the rail rests and upon which base the web of the rail rests; with a rail bolted between the vertical parts of said rail-shoe with the bolt holes in the web of said rail enlarged to provide for compression of the cushion and the probable unequal expansion and contraction of the rail and rail-shoe; with reinforcing bars, connected in the center of the track by insulated adjusting stirrup rod-couplings, placed at intervals, in place of bolts, to hold the rails in gage; with paving materials brought up flush with the top of the rails except a narrow groove on the inside of the rails where

the flanges of wheels run; with a row of paving brick placed on the outside of rails to furnish a means of getting at the bolts and the cover of manhole to conduit, without disturbing any other part of the paving; as and for the purpose shown and specified.

24. The combination in a railway roadbed and track construction of parallel reinforced-concrete stringers called primary concrete, connected by reinforced concrete extending between the rail-shoes and on the outside of the same, called secondary concrete; the primary and secondary coats of concrete bound together on outside of rail-shoes by vertical steel-reinforcing bars placed at intervals; the secondary concrete reinforced lineally by the rail-shoes and the conduits embedded in the same on the outside of the rails and laterally by a curved steel reinforcing bar extending across the track from rail-shoe to opposing rail-shoe and by the reinforcing and connected tie-rods; as and for the purpose shown and specified.

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

JOHN N. D. BROWN.

Witnesses:
O. C. STEPHENSON,
CY THOMAS.