A. F. L. VON BABO.

TRUNNION BASCULE BRIDGE.

APPLICATION FILED JUNE 26, 1908.

1,001,800.

Patented Aug. 29, 1911.

2 SHEETS—SHEET 1.

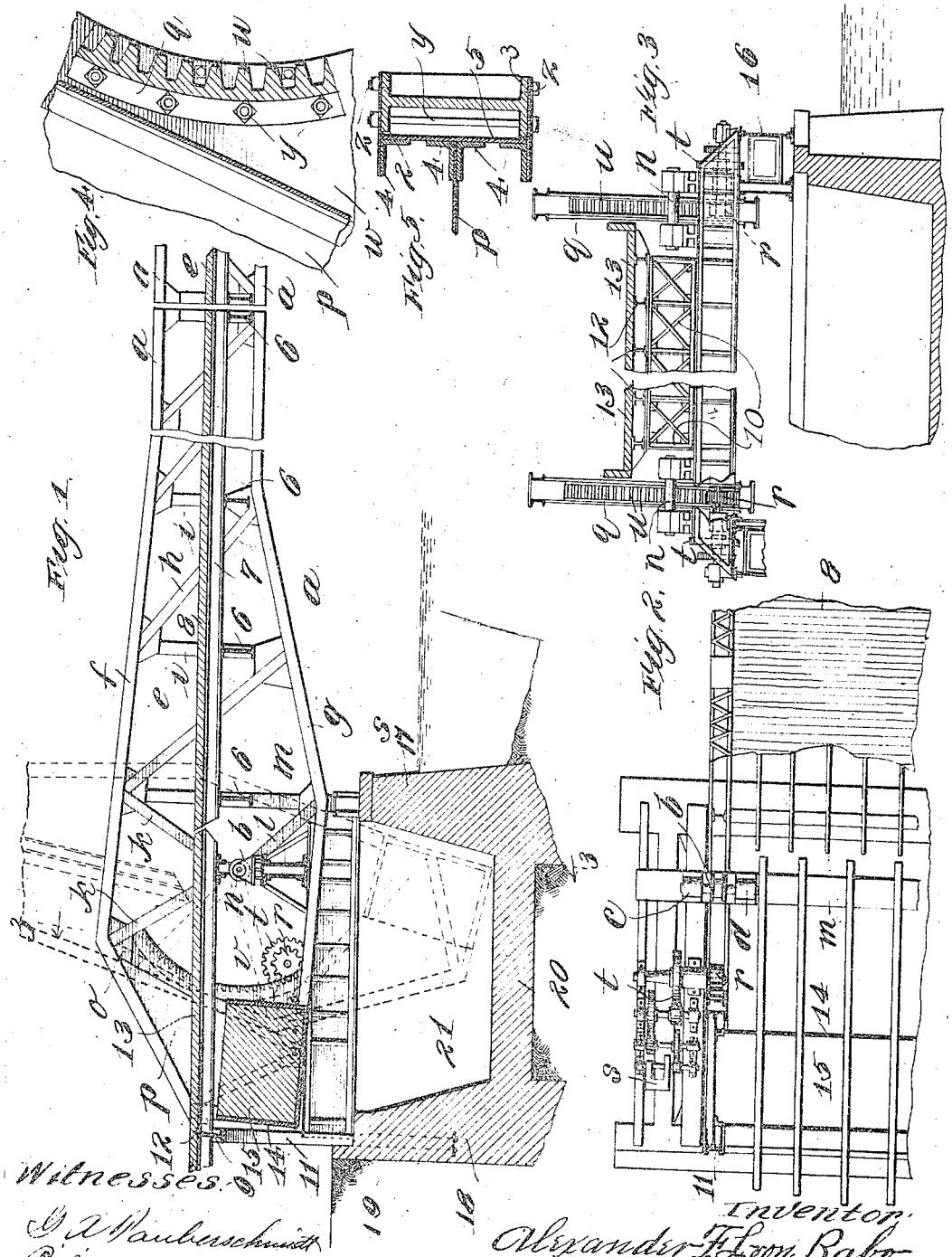

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Fig. 7.

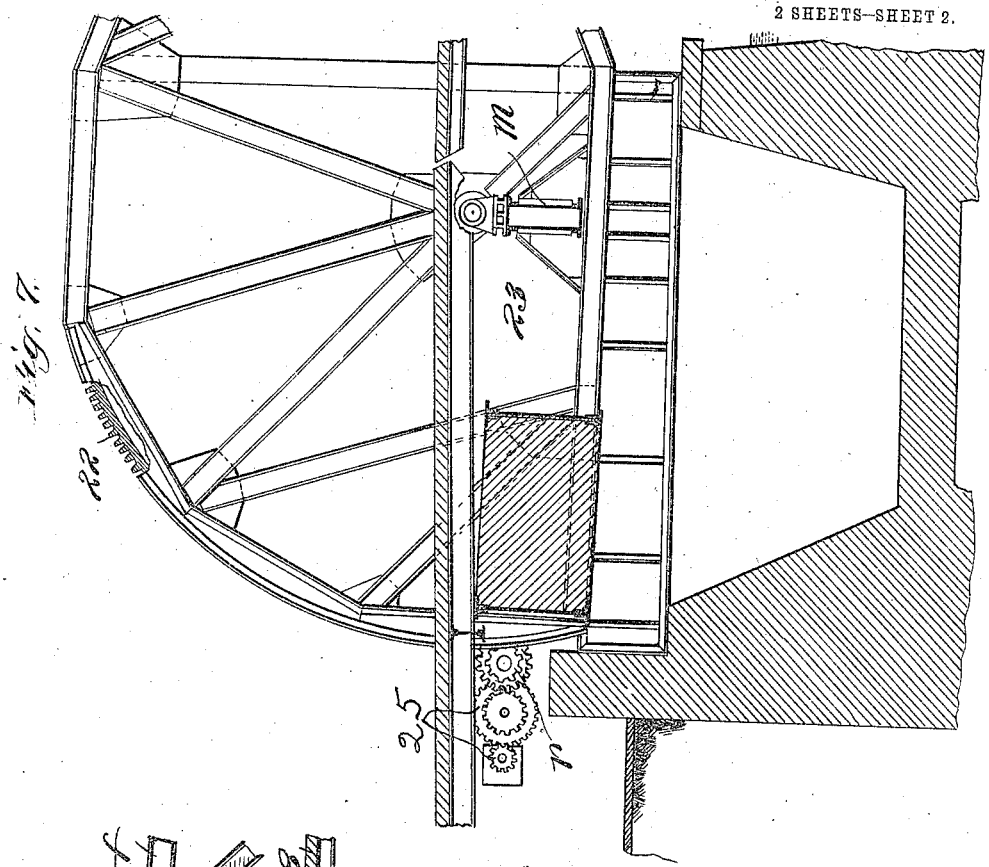
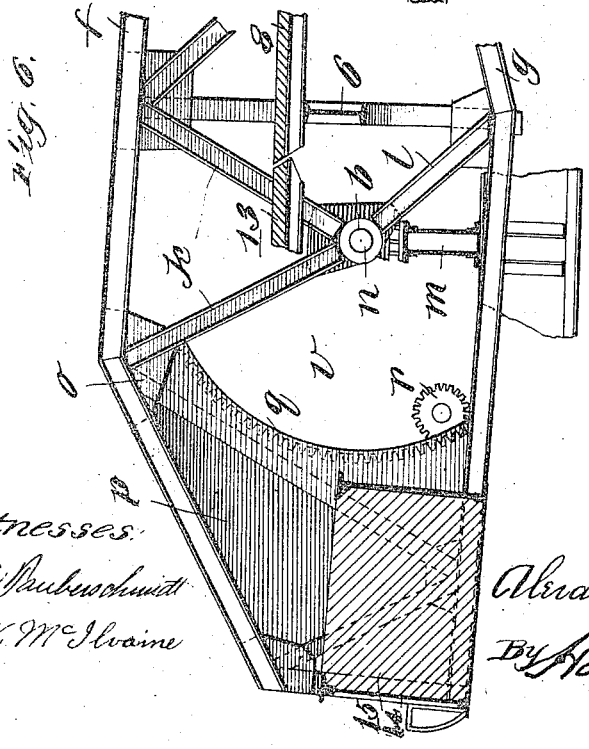


Fig. 6.



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TRUNNION BASCULE-BRIDGE.

1,001,800. Specification of Letters Patent. Patented Aug. 29, 1911.

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To all whom it may concern:

Be it known that I, ALEXANDER F. L. VON BABO, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Trunnion Bascule-Bridges, of which the following is a specification.

This invention relates to that class of bridges commonly known as trunnion bascule bridges, and having one or more spans or leaves supported by trunnions and provided with rack and pinion or gear mechanism for operating the same.

The principal object of the invention is to provide a simple, economical and efficient trunnion bascule bridge.

Other objects of the invention are to provide a trunnion bascule bridge having one or more movable leaves or spans, with main trusses or girders for each movable leaf or span, mechanism for operating the movable leaf or leaves, a stationary support or supports for the leaf operating mechanism and the movable leaf or leaves, and for the stationary floor, track or roadway, and trunnions connected with the movable leaf or leaves for supporting the same in movable relation to the stationary support or supports, all so constructed and arranged as to furnish ample space for a counterweight of the required dimensions, made of comparatively inexpensive material such as concrete, or stone or the like, thus dispensing with the necessity of limiting the size of the counterweight and using heavier and more expensive material for its construction; to enable such longitudinal inside girders, trusses, posts or supports for the inner ends of the trunnions as have hitherto been used and which limit the size of the counterweight boxes and counterweights to be dispensed with; to provide means whereby the entire machinery for operating the leaf or leaves can be placed alongside of the main trusses when desired, and whereby it is possible to readily dispense with operating struts reaching behind the anchor piers and requiring an extensive additional space for their motion and operation, and to avoid the use of unsightly circular racks above the top chords or beneath the bottom chords of the trusses, and the difficulties resulting from such construction.

Further objects are to provide a bascule bridge with a leaf or leaves having main trusses and trunnions, and a stationary support or supports for the trunnions, so constructed and arranged as to enable toothed or pin racks to be mounted between the top and bottom chords of the main trusses, and pinions upon stationary supports to extend between the top and bottom chords of the trusses in engagement with such racks for operating the leaf or leaves; and to enable a transverse girder or girders to extend through the main trusses of each movable leaf or leaves directly beneath the trunnions so as to form a suitable support for the movable leaf or leaves and the stationary floor or roadway between the trusses; said transverse girder or girders being also adapted to form a support for both the inner and outer ends of the trunnions or for the bearing blocks on opposite sides of the main trusses, and said trusses being provided with open panels forming apertures through which the transverse girder or girders extend so as to permit the free movement of the leaf or leaves.

Other and further objects of the invention will appear from an examination of the drawings and the following description and claims.

The invention consists in the features, combinations, and details of construction hereinafter described and claimed.

In the accompanying drawings Figure 1 is a central sectional elevation of a trunnion bascule bridge constructed in accordance with my improvements and showing the leaf in lowered position in full lines, and in raised position in dotted lines; Fig. 2 is a plan view of the same with certain parts broken away and others omitted for the purpose of clearness; Fig. 3, a view in transverse sectional elevation taken on irregular line 3 of Fig. 1, looking in the direction of the arrow, and showing the transverse girder in side elevation and extending through the apertures in the side trusses in position to support the trunnions and thereby the movable leaf, and also the inner stationary members or roadway; also showing the inner toothed sides of the racks and their position relative to the trunnions and apertured side trusses; Fig. 4, an enlarged detail view of a fragment of the rack and its supporting plate and connections by means of which it is secured in position between the top and bottom chords of the side truss of the trunnioned leaf; Fig. 5, a longitudinal sectional

view of the parts shown in Fig. 4; Fig. 6, a longitudinal sectional elevation of a movable leaf of a trunnion bascule bridge constructed in accordance with my improvements, showing one of the apertured side trusses and its rack and pinion, with parts broken away; and Fig. 7, a central longitudinal sectional elevation of a modified form of leaf or trunnioned span having apertured side trusses each provided with an outer rack and stationary pinion, and having a transverse supporting girder in supporting engagement with the trunnion and extending through the aperture or open panel in said truss, with certain parts omitted and a portion of the leaf being broken away,—only one side truss being shown.

In constructing a trunnion bascule bridge in accordance with my improvements I provide one or more movable trunnioned leaves or spans *a*, each provided with trunnions *b* mounted upon main side trusses *e*, said trunnions being mounted preferably in stationary journal blocks *c* and *d* on the outside and inside of the side trusses respectively. The side or main trusses *e* each have a top chord *f* and a bottom chord *g*, and connecting web members *h* and *i* or similar element, such as a web plate, for connecting the compression and tension members of the trusses or girders. Braces or web members *k* are connected with the hub of each truss and extend upward from the hub and trunnion to the top chord, and a web member *l* is connected with the hub and extends downward and toward the cantaliver or channel end of the span to the bottom chord of each main truss in position to provide an open space or aperture *v* the shoreward boundary or margin of which is formed by the web members *o* and *p* and the toothed or pin rack *q*. Said members *o*, *p*, and *q* are at a sufficient distance shoreward from the trunnions or pivotal center of the span to permit the required freedom of movement of the span or leaf when a transverse girder—hereinafter described—is in position to extend through said apertures or open panels and between the top and bottom chords of the trusses and directly beneath and in position to support the trunnions and leaf.

A rack *q* is mounted preferably between the top and bottom chords of each main truss of each movable span or leaf, and provided with pins, or teeth *u* on its concave side and toward the hub *n* and trunnion *b* so as to form a segmental or curved marginal member or shoreward boundary for the aperture *v* or open panel formed between each rack and the web members *k* and *l*. This aperture or open panel in each main truss is between the trunnions and the shoreward end of the leaf and has a lower portion beneath the trunnion and extending in the direction of the cantaliver or channel end of the span a sufficient distance to admit a stationary transverse girder or support directly beneath the trunnions. A pinion *r* is mounted upon a stationary support and extends into the open panel or aperture of each main truss between the top and bottom chords thereof, in toothed engagement with the rack in position to permit the reciprocation or movements of the rack and top and bottom chords of each truss in the same vertical plane with the corresponding pinion.

A motor *s*, or similar source of power, is mounted preferably outside of and adjacent to each side or main truss and upon a stationary support. And a train of gears *t*, or similar element, is mounted in operative engagement with each pinion and forms a connection between said pinion and the motor or source of power.

The racks are formed preferably of metal and consist of segments provided with teeth or pins. A very desirable construction and arrangement is shown in the drawings, consisting of a toothed rack member mounted preferably upon and between plates or web members *w* which may form a part of the truss. Bolts *y* extend through both of said web members *w* and through outer flanges 2 of the rack. Bolts *z* connect inner flanges 3 of the rack with the plates *w*, and said plates or web members are connected by means of angles 4 and a transverse web or plate 5 with the plate *p*.

The side trusses are connected by means of transverse floor beams 6 on which are laid stringers 7 extending longitudinally of the span of which they form a part, and the floor 8 of planks or equivalent elements is laid on said stringers.

The stationary floor or roadway here shown is constructed of a transverse floor beam 9 mounted upon posts 11, and transverse bracing 10 which is supported preferably upon or by the transverse girder *m*, stringers 12, and a floor of planks 13, or similar elements laid thereon. This floor or stationary roadway extends from a point beyond the shoreward end of the movable span to the movable floor of the leaf or span, and the end which is adjacent to the trunnions is supported by the transverse girder *m*, above mentioned, which extends through the main trusses of the leaf between the top and bottom chords thereof and directly beneath the trunnions. Trunnion supporting journal blocks *c* and *d* are mounted on the transverse girder *m* and support the outer and inner ends of the trunnions of the movable leaf. The girder *m* is preferably without any support between the trusses or trunnions and rests with its outer ends on longitudinal girders 16 placed outside of and parallel with the leaf trusses, but it may rest directly upon masonry bodies of the

substructure if the ground will allow such an arrangement of the substructure.

A suitable substructure is provided which consists of a river pier 17, an anchor pier 18, side walls 19, and a bottom 20, all formed of masonry properly reinforced, or of any ordinary or desired form and material. This sub-structure is provided with a counterweight pit 21 and forms a support for the longitudinal beams 16 and the transverse girder *m* which is adapted to rest either on the longitudinal beams or directly upon the sub-structure.

A counterweight box 14 is located below the stationary roadway or floor, where it is mounted on the shoreward end of the movable leaf between the main or side trusses already described. A counterweight 15, of stone, concrete or other material, is placed in the counterweight box, and by reason of the ample space afforded by the construction and arrangement of parts as above described, the counterweight may be made of material lighter and less expensive than iron without any undesirable crowding of the machinery or of any of the parts and without injuriously affecting the efficiency of the bridge as compared with more complicated and expensive constructions. A weight of sufficient size to properly balance the leaf may be located between the shoreward end of the leaf and the inner rack or the shoreward edge or margin of the open panels in the main trusses through which the transverse girder extends.

In Fig. 7, an outer curved circular rack 22 is shown, mounted upon a main truss of a trunnioned leaf, but on the outside of the truss or chord. The trusses of the leaf shown in said figure are provided with open panels or apertures 23 through which extends the transverse girder *m* between the chords of the trusses, in the manner already indicated, said girder forming a support for the river end of the stationary floor or roadway, and extending beneath and supporting the trunnions and thereby the movable leaf. The pinion *r* is mounted outside of the apertured truss in engagement with the outer rack teeth, and a train of gears 25 is operatively connected with said pinion and with a motor or other suitable source of power of any ordinary or desired form. The leaf having a circular shaped chord, as shown in Fig. 7, and having main trusses provided with open panels reaching beneath the trunnions, and the stationary transverse girder extending through said trusses between the top and bottom chords thereof and directly beneath the trunnions, permits an arrangement of the leaf-operating machinery and gears which—in case an exceptionally large lever arm for holding the leaf against the wind is desirable—may be of advantage, especially in cases where there is plenty of room available for placing the machinery behind the anchor piers.

By using circular racks within the chords of the trusses, as above described, the entire machinery for operating the leaf can be placed alongside of the main trusses, whereby operating struts reaching behind the anchor piers, and unsightly circular racks above the top chords or beneath the bottom chords of the main trusses are dispensed with. By the use of a heavy transverse girder or girders extending through the open panels or apertures in the main trusses between the top and bottom chords and directly beneath the trunnions, and having journal or bearing blocks mounted on the transverse girder in supporting engagement with the trunnions on the inside and outside of each apertured or trunnioned truss, said girder being supported by beams or masonry on the outside of the trusses, the otherwise needed inside girders, trusses or posts for supporting the inner ends of the trunnions can be dispensed with. Such longitudinal girders and inner supports for the trunnions as have hitherto been used, limit the size of the counterweight boxes and counterweights and necessitate the use of relatively heavy and costly material for counterweights. All of these objectionable features are minimized or overcome by the combinations of elements and the construction and arrangement of parts herein described and claimed.

It is to be understood that changes may be made in the structural details and in the outlines of the leaf trusses described herein, or shown in the drawings, without departing from the spirit of my invention, and I do not wish to be limited to the details, construction, or outlines herein shown and described except as set forth in the claims.

I claim:—

1. In a trunnion bascule bridge, the combination of a movable leaf having main trusses or girders, a circular rack mounted between and located in the same plane with the chords of a main truss of said leaf, and inclosed by said chords, and a rack pinion in engagement with said rack and located between the chords of the truss upon which the rack is mounted.

2. The combination of a movable leaf having main trusses or girders, trunnions upon which said leaf is mounted, a stationary support for said trunnions, a rack mounted within the chords of a main truss and rigidly secured to said truss and movable in the same plane therewith, a pinion in engagement with said rack and located between the chords of said truss, and a stationary support for said pinion.

3. In a trunnion bascule bridge, the combination of a movable leaf or span having main trusses or girders, trunnions upon

which said leaf is mounted, a stationary support for said trunnions, circular racks located between and in the same plane with and inclosed by the chords of and rigidly connected with said main trusses, pinions in engagement with said racks between the chords of said trusses, stationary supports for said pinions, and means for operating the pinions and thereby the racks and the leaf or span with which the racks are connected.

4. In a trunnion bascule bridge, the combination of a movable leaf or span having main trusses or girders each provided with an aperture, a rack secured to each truss and located between and in the same plane with and inclosed by the chords thereof forming a boundary for said aperture, a stationary pinion mounted in engagement with each of said racks and located between the top and bottom chords of the truss in which the engaged rack is mounted, trunnions in supporting engagement with the leaf, and means for supporting said trunnions and thereby the leaf.

5. In a trunnion bascule bridge, the combination of a movable leaf or span having main trusses or girders each provided with an aperture, a stationary transverse girder extending through said apertures and between the chords of the trusses, stationary longitudinal girders upon which said transverse girder rests, and trunnions connected with said movable span and supported by said transverse girder.

6. In a trunnion bascule bridge, the combination of a movable leaf or span having a main truss provided with an open panel forming an aperture through the truss between the chords thereof, a stationary transverse girder extending through said aperture and between the chords of the truss, stationary longitudinal girders upon which said transverse girder rests, trunnions mounted upon said transverse girder and connected with the truss, for supporting the leaf, a circular rack mounted upon and rigidly connected with the truss, a pinion in engagement with said rack, for operating it and thereby the leaf, and means for operating the pinion and thereby the leaf.

7. In a trunnion bascule bridge, the combination of a movable leaf or span having main trusses each provided with an open panel forming an aperture between the chords of the truss, a stationary transverse girder extending through said apertures and through and between the chords of the trusses, a circular rack mounted between and in the same plane with and inclosed by the chords of and rigidly secured to a main truss, a pinion located between the chords of the truss in engagement with said rack, gear mechanism operatively connected with said pinion, and means for operating said gear mechanism and pinion and thereby the rack and movable leaf.

8. In a trunnion bascule bridge, the combination of a movable leaf having main trusses each provided with an aperture between the chords thereof extending beneath the pivotal center of the leaf, trunnions for supporting said leaf, a stationary transverse girder extending through said apertures and between the chords of said trusses beneath said trunnions and the pivotal center of the leaf and connected with the trunnions for supporting them and thereby the leaf and stationary longitudinal girders upon which said transverse girder rests.

9. In a trunnion bascule bridge, the combination of a movable leaf having main trusses each provided with a transverse aperture between the chords thereof, a portion of which aperture extends beneath the pivotal center of the leaf and a portion of which extends between the shoreward end and pivotal center of the leaf, a stationary transverse girder extending through said apertures and between the chords of the main trusses of said movable leaf, stationary longitudinal girders upon which said transverse girder rests, trunnions supported by said transverse girder and connected with the leaf, a rack secured to a main truss of said leaf, a pinion in engagement with said rack, a stationary support for the pinion, and means for operating the pinion and thereby the rack and the movable leaf.

10. In a trunnion bascule bridge, the combination of a movable leaf having main trusses each provided with a transverse aperture between the chords thereof, a portion of which aperture is beneath the pivotal center of the leaf and a portion of which is between the shoreward end and pivotal center of the leaf, a stationary transverse girder extending through said apertures and between the chords of said main trusses of the movable leaf, stationary supports for said transverse girder, trunnions supported by said transverse girder and connected with the leaf, a curved rack secured to a main truss of said leaf between the top and bottom chords thereof and in the same plane with and inclosed by said chords, said rack having an inner toothed portion, a pinion located in the aperture in said truss in toothed engagement with said rack between the chords of the truss, means for supporting said pinion, and gear mechanism connected with the pinion for operating it and thereby the rack and the movable leaf.

11. In a trunnion bascule bridge, the combination of a movable leaf having main trusses or girders each provided with an open panel forming a transverse aperture between the chords thereof, a stationary transverse girder extending through said

apertures and through and between the chords of said trusses, bearing blocks supported by said girder, trunnions mounted in said bearing blocks and connected with the trusses of the movable leaf for supporting said leaf, stationary longitudinal girders upon which said transverse girder rests, and means for operating said movable leaf.

12. In a trunnion bascule bridge, the combination of a movable leaf having main trusses or girders each provided with an open panel forming a transverse aperture between its chords, a stationary transverse girder extending through said apertures and through and between the chords of said trusses, stationary longitudinal girders upon which said transverse girder rests, trunnions supported by said transverse girder and connected with the leaf for supporting the leaf in movable relation to the girder, transverse frame members connecting the main trusses of the movable leaf, a platform supported by said transverse frame members, and a stationary floor located between the main trusses of the movable leaf and having one end supported by said transverse girder.

13. In a trunnion bascule bridge, the combination of a movable leaf having main trusses or girders each provided with an open panel forming a transverse aperture through the truss between the chords thereof, circular tracks rigidly connected with the truss members and forming one boundary line of said apertures, rack pinions mounted upon stationary supports and extending into said apertures between the top and bottom chords of the trusses and in engagement with said racks, stationary motors, gears connecting said motors with said rack pinions, and trunnions connected with the leaf and supported by said cross girder.

14. In a trunnion bascule bridge, the combination of a movable leaf or span having main side trusses each provided with an open panel forming a transverse aperture through the truss between the chords thereof, trunnions in supporting connection with said leaf, transverse beams connecting the side trusses of the movable leaf, a platform supported by said transverse members and forming a track or roadway for vehicles, a stationary roadway located between the side trusses of the leaf, a transverse girder extending through the apertures in the side trusses and forming a support for the stationary roadway and the trunnions and movable leaf and stationary longitudinal girders upon which said transverse girder rests.

15. In a trunnion bascule bridge, the combination of a movable leaf provided with main trusses each having a top and bottom chord and having an aperture between said chords, a toothed rack mounted between and in the same plane with and inclosed by the top and bottom chords of a main truss of said movable leaf, a pinion in engagement with said rack and extending between the chords of the truss in which the rack is mounted, trunnions in supporting engagement with said leaf, means for supporting said trunnions and thereby the leaf, means for supporting said pinion, gear mechanism for operating the pinion, and a counterweight mounted on the leaf between the shoreward end thereof and the rack, for balancing the leaf.

16. In a trunnion bascule bridge, the combination of a movable leaf provided with main trusses each having a top and bottom chord and having an aperture between said chords, trunnions connected with said leaf for supporting it, a stationary support for said trunnions, transverse beams connecting the main trusses of the leaf, a rack rigidly secured to a main truss of said movable leaf and extending upward and downward between the chords of said truss and between the shoreward end and pivotal center of the leaf, a web member mounted between the rack and the shoreward end of the truss and rigidly connected with the rack, a pinion in engagement with said rack and extending between the chords of the truss in which the rack is mounted, means for operating said pinion and thereby the rack and movable leaf, and a counterweight mounted on the movable leaf between said rack and the shoreward end of the leaf.

17. In a trunnion bascule bridge, the combination of a movable leaf having main trusses or girders each provided with an open panel forming an aperture therethrough, a transverse girder extending through the apertures and between the top and bottom chords of said main trusses, stationary supports extending longitudinally of the leaf on the outside of the main trusses and in supporting engagement with said transverse girder, and a plurality of trunnions supported by said transverse girder and in supporting engagement with said main trusses.

18. In a trunnion bascule bridge, the combination of a movable leaf having main trusses or girders each provided with an open panel forming a transverse aperture therethrough between the chords thereof, a transverse girder extending through a plurality of said trusses between the top and bottom chords thereof, stationary longitudinal girders upon which said transverse girder rests, bearing blocks mounted on said transverse girder on opposite sides of each of said main trusses, and a plurality of trunnions mounted in said bearing blocks in supporting engagement with the main trusses.

19. In a trunnion bascule bridge, the combination of a movable leaf having main trusses or girders each provided with an

open panel forming an aperture therethrough, a transverse girder extending through the apertures and between the top and bottom chords of a plurality of said main trusses, stationary longitudinal girders upon which said transverse girder rests, trunnions in supporting engagement with a plurality of said trusses, bearing blocks mounted on said transverse girder on opposite sides of each of the main trusses and in supporting engagement with the trunnions, and means for operating the leaf.

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