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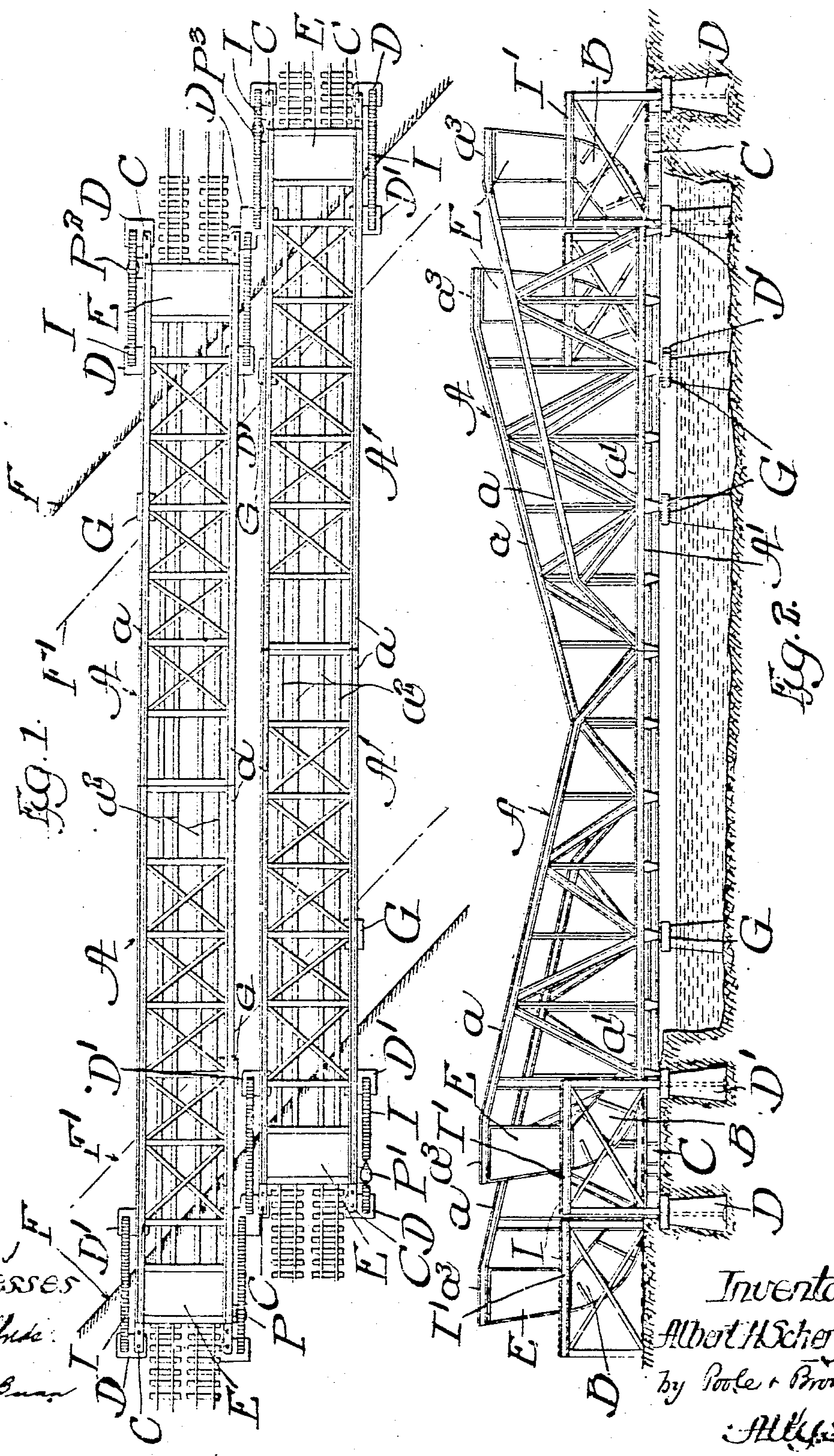
BASCULE BRIDGE.

APPLICATION FILED JULY 30, 1907.

963,399. Patented July 5, 1910.

4 SHEETS—SHEET 1.



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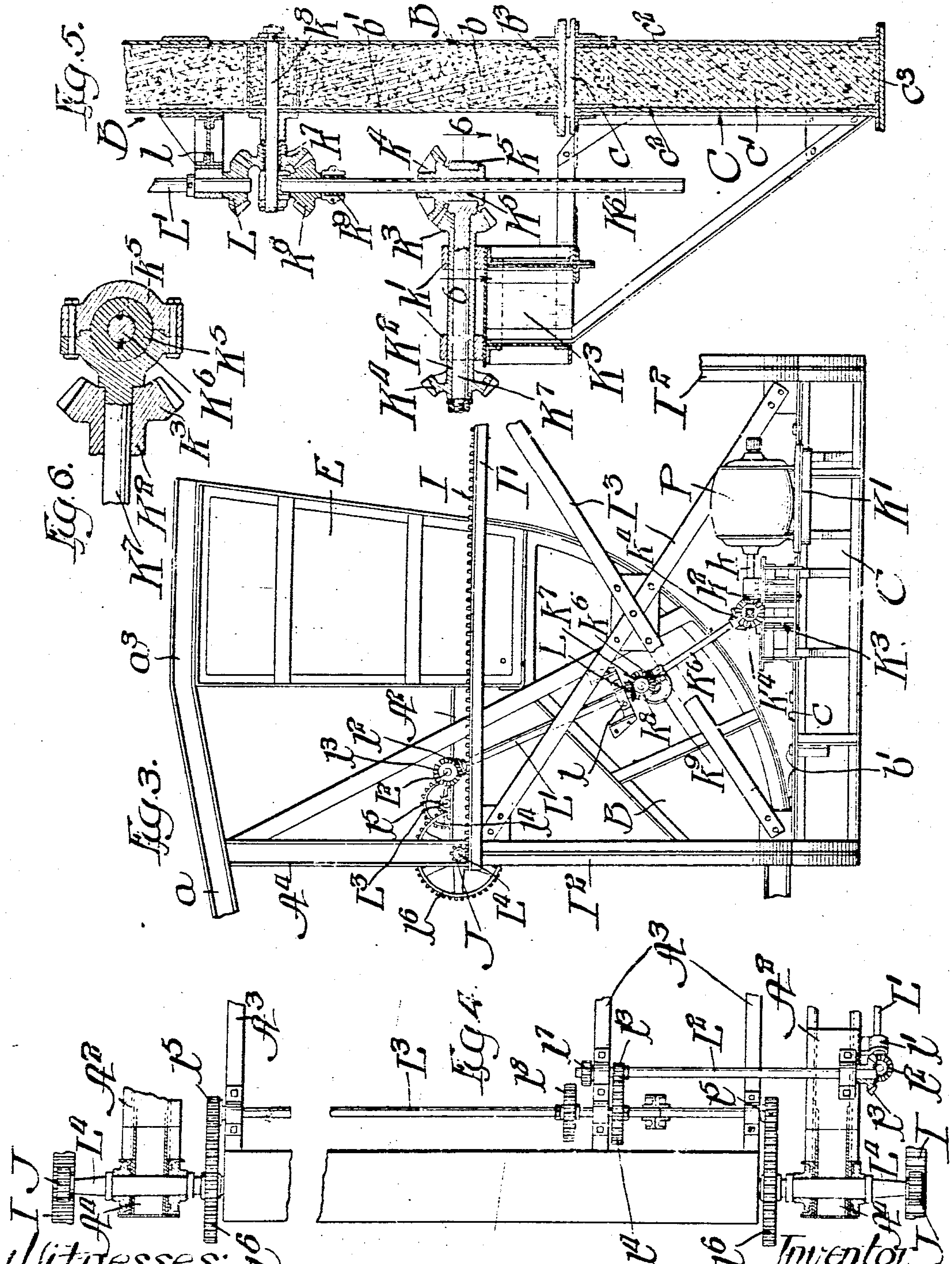

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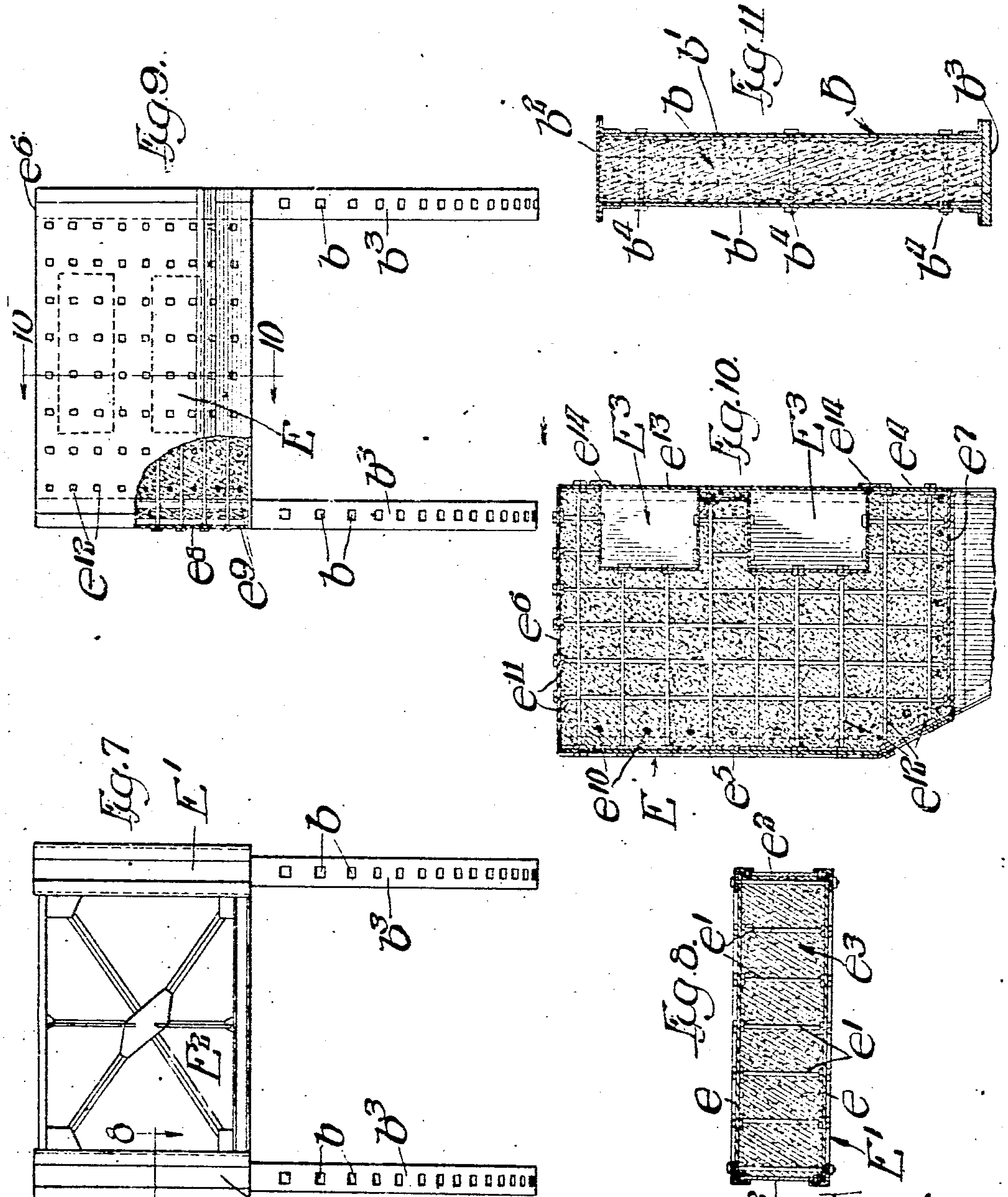

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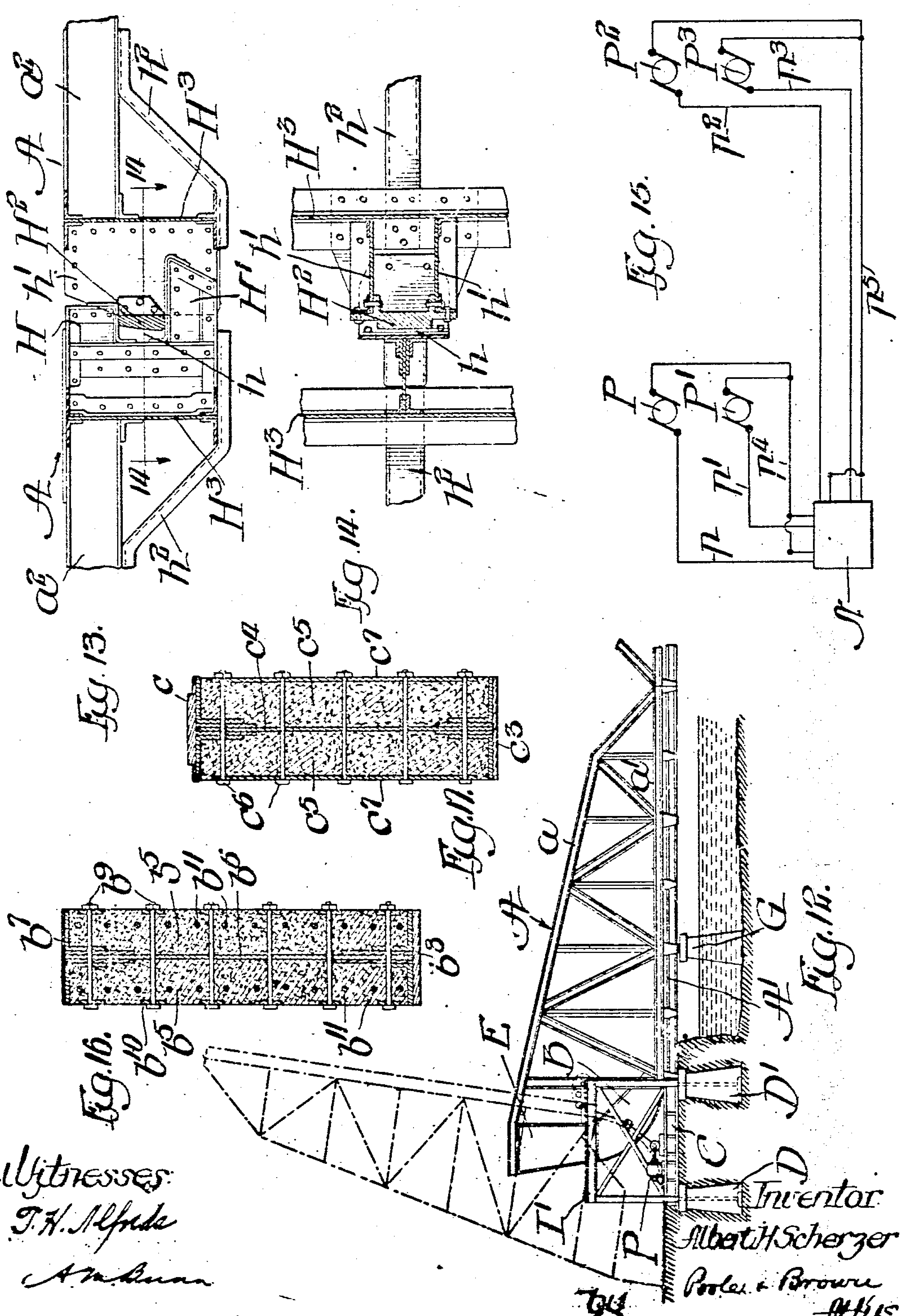

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UNITED STATES PATENT OFFICE.

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BASCULE-BRIDGE.

963,399. Specification of Letters Patent. Patented July 5, 1910.

Application filed July 30, 1907. Serial No. 386,255.

To all whom it may concern:

Be it known that I, ALBERT H. SCHERZER, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Bascule-Bridges; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in bascule or lift bridges of that kind wherein the bridge is opened and closed by the swinging movement of a movable leaf or leaves in a vertical plane.

The invention consists in the matters hereinafter set forth and more particularly pointed out in the appended claims.

One of the features of my invention is embraced in a skew bridge or one which crosses a waterway obliquely or at an angle thereto. This feature of the invention consists in a supporting pier located outside of the abutment or main bridge supports on which the spans rest when lifted, and which serve to give cantaliver support to the swinging bridge leaf, thereby decreasing the length of the unsupported part of the span when the bridge is closed, with corresponding increase of load carrying capacity.

A further feature of the invention resides in the construction and operation of multiple leaf bridges, by which term is meant either a plurality of single leaf spans located side by side, a plurality of double leaf spans located side by side or a single double leaf span, and arranging the operating motors and the controlling devices therefor in such relation that the operating machinery of all of several spans may be operated from a single controller house. When the bridge leaves are located side by side they may be operated to open or close simultaneously or progressively as desired.

A further feature of the invention resides in the machinery which operates to open and close the bridge and is driven by a motor located on a stationary approach or other stationary structure.

A further feature of my invention resides in the construction of the counterweight by which the bridge structure is counterbalanced, the said counterweight being so constructed and arranged as to constitute means for reinforcing and strengthening the bridge structure in addition to its usual function of counterbalancing the structure.

A further feature of the invention resides in the construction of the counterweight whereby the same consists of a metal structure or inclosure provided with a filling of concrete or plastic material.

A still further feature of the invention resides in reinforcing the rolling segments by which the bridge leaf is supported, with concrete or plastic material.

I have shown my invention as applied to a double leaf bridge arranged obliquely of the waterway and wherein each complete bridge comprises two leaves which meet at their front ends between the supporting piers or abutments.

Features of my invention relating to a bridge which is supported outside of the usual abutment by a pier arranged outside of the abutment or main support for the swinging leaf are especially applicable to double leaf skew bridges such as is shown in the drawings, but are also applicable to the type of skew bridge comprising a single leaf which is supported at its rear or approach end upon the usual abutment or main support, and at its front end upon a stationary pier or upon a stationary approach span, as the case may be.

Other features of my invention are applicable to either ordinary or skew bridges.

My improvements as herein shown are applied to that type of bascule bridge known as a rolling lift bridge, but certain of the improvements may be adapted to other types of bascule bridges.

As shown in the accompanying drawings:—Figure 1 is a top plan view of two double leaf bridges located side by side. Fig. 2 is a side elevation thereof. Fig. 3 is a side elevation of the rear end of the bridge showing the operating machinery and the supports which carry the same. Fig. 4 is a fragmentary top plan view of the operating machinery. Fig. 5 is a section taken through the rolling segment and its supporting girder, showing that portion of the machinery which is mounted on the segment. Fig. 6 is a sectional view taken on line 6—6 of Fig. 5. Fig. 7 is a rear elevation of one of the bridge leaves showing one approved construction in the counterweight. Fig. 8 is a section taken on line 8—8 of Fig. 7. Fig. 9 is a view similar to Fig. 7 showing a modified form of counterweight. Fig. 10 is a vertical section taken on line 10—10 of Fig. 9. Fig. 11 is a section taken through the rolling segment. Fig. 12 is a side elevation of one of the bridge leaves illustrating the open position thereof. Fig. 13 is a detail illustrating a form of center lock for locking the bridge leaves together. Fig. 14 is a section taken on line 14—14 of Fig. 13. Fig. 15 is a diagram illustrating the manner of wiring electric motors which operate the bridge so as to control the motors from a single controller station. Figs. 16 and 17 are sectional views showing modified forms of construction in the rolling segment and track girder.

As shown in the said drawings, A A designate the separate leaves of the bridges, all of which are alike. Each leaf comprises upper and lower chords a a^1 and a floor structure A^1 located substantially at the level of the lower chords. The bridge illustrated is a railway bridge, the track rails being supported on cross ties that rest on stringers a^2 a^2 constituting part of the floor structure.

B B designate rolling segments arranged in the plane of the side trusses of the bridge, at the approach or rear end of each leaf. Said segments rest and roll on tracks c carried by horizontal girders C C, which are hereinafter termed track girders. The said track girders are supported at their ends on piers D D^1 located at the shore of the waterway. The said track girders are provided with means for preventing slipping or shifting of the segments thereon, said means comprising teeth b^1, (Fig. 3) arranged along the girders and holes or recesses b in the curved faces of the segments (Figs. 7 and 9) adapted to receive such teeth.

E E designate counterweights which are attached to bridge trusses above the segments B, and extend from the upper ends of said segments to rearward extensions a^3 of the upper chords of the said trusses. Said counterweights E serve to counterbalance the span, in the usual manner, so as to permit the raising and lowering of the bridge leaves with minimum power.

It will be noted from an inspection of Fig. 1 that the track girders C C are arranged parallel with the bridge trusses or roadway of the bridge; this being in fact essential in a rolling lift bridge. By reason of this disposition of the track girders they stand obliquely to the shore lines of the waterway and the outermost piers D^1 D^1, which support the outer ends of each pair of track girders, as shown in said Fig. 1, are located, one on the shore inside of the shore line, indicated by F, and the other outside of the shore line, but inside the line of the navigable channel, indicated by the dotted line F^1. In any instance of this kind, one of the piers will necessarily be located nearer than the other to the channel of the waterway, and it therefore becomes possible, without encroachment on said channel, to place another pier, indicated by G, outside of the shore line and in longitudinal alinement with the pier D^1 which is located inside of the shore line. Said pier G, thus located, is adapted to support the leaf, when in its horizontal or closed position, by contact therewith of the leaf truss at the side of the leaf at which said pier is located. As shown in said Fig. 1, the pier G is located just inside of the line F^1 and in position to directly support the said leaf at the side of the latter adjacent to the pier D^1 which is located on the shore.

It will be observed that both leaves of each bridge are supported at one side by one of the piers G and that the piers associated with the two leaves of the bridge are located at opposite sides of the bridge. The two leaves of the span will, in accordance with the usual practice, be locked together at their meeting ends by a locking device adapted to hold the same from relative vertical movement, so that when the bridge is closed the two leaves are supported not only by the main supports or track girders by which the leaves are sustained when raised, but also by the said piers G located in each instance at a distance outside of said main supports or track girders. The effective span of the bridge as a whole is thereby substantially decreased, its unsupported part being equal in length to the distance between the two piers G G, thereby giving to the bridge an increased load bearing capacity. In another aspect the construction described embracing the auxiliary piers G G, may be termed a modified cantaliver form of bridge, it being seen that one of the side trusses of each leaf is supported at two points, to-wit, at the point at which its rolling segment rests on its track girder and at the point at which the said truss rests on the pier G, so that the outer end of the truss so supported cannot be depressed without rocking the same upon the said pier G, with the effect of lifting the rear end of the leaf. Any such lifting of the rear end of the leaf will be prevented by the weight of the span inside of said pier G, together with the counterbalance weights thereon located and also by the anchored stops usually employed in bridges of this class to limit the upward movement of the rear end of the leaf and the descent of its front end. This feature of an auxiliary supporting pier located outside of the track girders or main support on which the swinging leaf rests when lifted, and adapted to support the leaf in the manner described when the same is in its closed position may be applied with advantage in some instances to other kinds of bascule bridges, it being manifest that the general effect of such an auxiliary supporting pier will be the same whether it be used to support one of the trusses only of a leaf extending obliquely to the waterway, or both trusses of a leaf arranged at right angles to the waterway such as is shown in Fig. 12. Such an auxiliary pier, however, has special advantages in connection with the obliquely arranged or skew bridge illustrated, because in such a bridge the total distance between the outer supporting piers for the track girders may be so arranged as not to encroach upon the waterway, while the auxiliary supporting pier, when located beneath one only of the leaf trusses, as hereinbefore described, may be located at a considerable distance from the shore line of the waterway, without encroaching upon the latter.

A practical form of center lock is shown in Figs. 13 and 14, which is termed a structure lock, that is to say a lock wherein the interlocking parts thereof are rigid with the structure of the bridge leaves, and are brought together in interlocking relation by the movement of the front ends of the leaves downwardly to their closed position. This form of lock, briefly described, comprises an upper and a lower extension H, H^1, respectively, carried by and extending forwardly from one of the leaves. The upper locking extension is made shorter than the lower one, and said extensions are separated by a notch or recess h. The companion leaf of the span is provided with a horizontal locking extension H^2 which is fixed to upright parallel plates or webs h^1 h^1 extending forwardly from said leaf, and said locking extension H^2, when the leaves occupy their closed position, enters the notch between the extensions H H^1, while the lower extension H^1 enters the space between the laterally separated plates h^1 h^1. The extension H is short enough to permit said locking member H^2 to swing into the notch h during the closing movement of the leaves, while the longer extension H^1 limits the downward movement of the leaf carrying the locking member H^2 and guides the latter into the notch as the leaves approach their closed position. The locking members or projections H H^1 are secured to a transverse girder H^3, which extends across the front ends of the floor structure of the leaf carrying the same, while the plates h^1 of the lock member H^2 are likewise secured to the transverse girder H^3 of the other leaf, the parts being braced to longitudinal beams a^2 a^2 of the leaf structures by bracing members h^2 h^2. It will be understood that said locking members are located adjacent to the planes of the trusses at the lower chords thereof, there being two pairs of such locking devices usually applied to each two leaf span.

It will be furthermore observed that the locking devices made as described are adapted to perform an important function in connection with a two leaf bridge having the auxiliary supporting piers G G hereinbefore described. This will be understood by consideration of the fact that the projections H H^1 of each locking member are applied to the ends of the truss of each leaf, which is supported on the pier G, so that the lower extension H^1 constitutes a horizontal support for the locking member H^2 fixed to the truss at the same side of the other leaf, which latter truss is non-supported between its ends. The said locking device therefore constitutes a connection between said leaves, which sustains both the live and dead loads on the trusses which are unsupported between their ends. By reason of the fact, therefore, that the two oppositely disposed trusses of each pair of leaves are supported between their ends by the auxiliary piers G and carry at their outer ends the supporting extensions H^1 of the center locks, and that the other two trusses of said leaves are supported at their outer ends by said lower extensions H^1, the span as a whole, when the leaves thereof are locked together, constitutes a continuous structure supported at its ends and sustained at two points intermediate to its ends by said auxiliary piers. The stress due to the live load on the trusses which are unsupported between their ends is transmitted through the locking connection described to the inner ends of the trusses which are supported between their ends by said piers G. The load on the ends of the trusses which are supported by said piers tends to depress the outer and elevate the rear ends of said trusses, but the weight of the leaf structures in rear of said auxiliary piers is, however, so proportioned that it will never be overbalanced by any normal live load brought thereon.

Referring next to the mechanism for operating the bridge to open and close the same, said operating devices are made as follows: The said operating device is of the general type shown in the prior U. S. Letters Patent to Kellar No. 752,563, and embraces fixed horizontal rack bars I I, located one at each side of and exterior to the planes of each truss of each leaf, which are engaged by gear pinions J mounted on the movable leaf and operated by driving connections hereinafter to be described. The said rack bars I are mounted on stationary horizontal girders I^1 attached at their ends to columns I^2 I^2 that are anchored in the piers D^1, the frame composed of the said members I^1 I^2 I^2 being braced by oblique struts I^3 I^3. The feature of my invention associated with this construction relates to mechanism for driving the pinion J from a motor located on the stationary part of the bridge structure.

The driving machinery and the means for connecting the same with the motor are shown best in Figs. 3 to 6, inclusive, and are made as follows: P designates a motor which is mounted on a bracket K^1 (Figs. 1 and 3) shown as attached to the outer side of the track girder C. The armature shaft *k* of said motor has geared connection with a rotative horizontal, hollow shaft K^2, arranged at right angles to the track girders and mounted in bearings k^1 k^1 supported on a second bracket K^3 attached to the same side of the track girder. The gearing connecting the motor shaft *k* with the sleeve K^2 consists of bevel gears, of which the one attached to the outer end of said sleeve is indicated by K^4 in Figs. 3 and 5 and the one on said shaft by k^2 in Fig. 3. Said hollow shaft K^2 is provided at its inner end with a pinion K^3 which meshes with a gear wheel k^4 affixed to a sleeve K^5 which has endwise sliding splined connection with a shaft K^6, which is mounted at its upper end on the bridge leaf and is adapted for oscillatory movement in a vertical plane. The splined connection between said sleeve K^5 and the shaft K^6 operates to transmit motion from the sleeve to said shaft, while permitting the shaft to slide endwise in the sleeve. The sleeve K^5 is adapted to swing or oscillate in the same vertical plane with the shaft K^6, being mounted in a bearing k^5 attached to the inner end of a shaft K^7 that extends through and has bearing in said hollow shaft K^2, (Fig. 5). Said bearing k^5, by the turning of said shaft K^7, is adapted to oscillate on a horizontal axis at right angles to the plane in which the shaft K^6 and sleeve K^5 have oscillatory movement. The said shaft K^6 is provided at its upper end with a beveled pinion k^6 that meshes with an idler gear wheel k^7 which is rotatively mounted on a horizontal stud k^8 fixed to and extending laterally from the rolling segment B. The upper end of the shaft K^6 has bearing in a hanger k^9 which is provided with a hub which surrounds the stud k^8 outside of the idler gear k^7. Said hanger is thereby adapted to swing on a horizontal axis, thus permitting the lower end of the shaft K^6 to swing or oscillate in a vertical plane on the bridge leaf. The idler gear wheel k^7 meshes with a pinion L which is affixed to the lower end of a connecting shaft L^1, having bearing at its lower end in a bearing bracket *l* fixed to the lateral face of the rolling segment B. Said shaft L^1 has bearing at its upper end in a bracket l^1 (Figs. 3 and 4) attached to one of two horizontally arranged, machinery supporting frame members A^2 A^2 on the truss of the bridge leaf. Said upper end of the shaft L^1 is provided with a pinion l^2 which meshes with a gear pinion l^3 fixed to a transverse, horizontal shaft L^2 rotatively mounted on longitudinal, machinery supporting members A^3 A^3 on the truss structure (Fig. 4). The said shaft L^2 carries a gear wheel l^{13} which meshes with a gear wheel l^4 on a counter shaft L^3 mounted in said machinery supporting members A^3 A^3 and provided at its ends with gear pinions l^5 l^5 which mesh with gear wheels l^6 l^6 affixed to the inner ends of short rotative stub shafts L^4 L^4 mounted on the leaf trusses, and shown as extending through and having bearing in the truss uprights A^4 A^4. Said shafts L^4 L^4 are provided at their outer ends with rigidly attached gear pinions J which have meshing engagement with the racks I I carried by the stationary operating struts I^1 I^1. The shaft L^2 and countershaft L^3 are provided, in addition to the gear pinions l^{13} and wheels l^4, with a gear pinion l^7 and gear wheel l^8, differing in diameter from the pinion l^{13} and wheel l^4, the gear wheels l^7 and l^8 being adjustable longitudinally of the shaft so that either may be brought into use to vary the speed of the driving mechanism, in a familiar manner.

All parts of the driving machinery described, above the pinion L of the shaft L^1, are mounted in fixed relation to the bridge leaf and its rolling segment. Inasmuch as the shafts K^6 and hanger k^9, are mounted so as to be capable of oscillatory motion on the stud k^8 and the shaft K^6 is adapted to slide through the oscillatory, rotative sleeve K^5, it follows that during the rolling movement of the segment B and the bridge leaf, as the pivotal support of said shaft the stud k^8 approaches toward and recedes from said sleeve, the shaft K^6 slides through the said sleeve K^5. This mechanism permits the driving machinery mounted on the movable leaf to be positively driven through the medium of driving gears and shafts while at the same time giving the necessary flexibility in the connections between the stationary and movable parts of the driving mechanism.

It will be observed that the sleeve K^5 having splined engagement with the shaft K^6, said sleeve and shaft constitute in effect two driving members having sliding but nonrotative connection with each other. It will also be observed that the two relatively sliding members referred to, namely, the sleeve K^5 and the shaft K^6, are severally mounted in bearings and are pivotally supported in a manner permitting them to swing or oscillate on parallel, horizontal axes; one of said bearings being so pivotally supported on the bridge approach and the other upon the bridge span. That is to say the pivotally supported bearing k^5 for the sleeve K^5 is sustained by the horizontal shaft K^7, which, being free to turn or rotate on a horizontal axis, enables the said sleeve to swing in a vertical plane parallel with the plane of movement of the bridge span, while the bearing for the shaft K^6, which is formed by the hanger k^9, is adapted to swing freely about the horizontal pivot stud k^5 thereby permitting the said shaft to swing freely in the same vertical plane with said sleeve. Manifestly, the particular arrangement of these parts illustrated need not be adhered to in carrying out my invention, the essential feature being that the operative connections between the rotative driving shaft on the bridge approach and the rotative operating shaft J on the swinging leaf shall embrace two relatively sliding rotative members have splined connection with each other (as for instance the shaft K^6 and the sleeve K^5), said members being severally mounted in bearings on the leaf and approach, which bearings are adapted to turn or swing about parallel, horizontal axes, and one of said members having operative connection with said driving shaft and the other member with the operating shaft on the bridge leaf. The driving connections between the said relatively sliding members and the parts which drive and are driven are adapted for operation at all points in the oscillatory or swinging movement of said members about the pivotal axes of their bearings. The driving connections referred to, in the construction illustrated, are afforded by the gear pinion k^3 which intermeshes with the gear pinion k^4 on said sleeve and which, being concentric with the pivotal axis of the bearing k^5 of said sleeve, maintains the necessary driving connection in all angular positions of said sleeve, and likewise such driving connections between the shaft K^6 and the shaft L^1 includes the idler gear wheel k^7 which intermeshes with the gear pinions k^6 and L on said shafts and which, being concentric with the pivotal axis of the hanger k^3, maintains driving connection with the shaft K^6 in all angular positions of said shaft.

If the operating machinery for the bridge leaf be adapted for operating a single leaf bridge, the motor therefor may be located in a controller house or station and suitably geared to the operating machinery of the bridge leaf, or it may be located in any suitable manner on the stationary part of the bridge structure and geared to the operating machinery. If the motor be a gasolene motor or a steam engine and operates through the mechanism described to raise and lower the bridge, it may be desirable to locate said motor in the controller house, which house may be located in any suitable position on a stationary part of the bridge structure or the shore.

In accordance with one feature of my invention, I provide a multiple control system or means for operating a plurality of bridge leaves from a single controller house or station. This feature of my invention is adapted to effect the operation either of a plurality of single leaf bridges, a plurality of double leaf bridges located side by side, or the two leaves of a two-leaf, single span bridge, in cases in which it is necessary to locate the operating motors one at each end of the bridge. When the multiple control system is employed for operating a number of single-leaf bridges located side by side, and with the rear ends thereof located on the same side of the waterway or bridged space, all of the said leaves may be operated from a single motor geared in any suitable manner to the operating machinery of the several leaves, or each of the leaves may be provided with its own electric motor and a controlling circuit employed, which is arranged to extend from the several motors to a single controlling house or station. When operating a two leaf single span bridge, it is preferable to provide the two leaves on the opposite shores of the waterway each with an actuating motor and to connect said motors with the controller house by conducting wires, and this practice will also be followed for operating a number of spans located side by side, each consisting of two leaves and having two operating motors located one on each shore of the waterway.

Obviously my multiple control system may be applied to any type of operating machinery. In the construction illustrated each operating motor P is supported on one of the track girders associated with the leaf which it is designed to operate. In Fig. 15 I have shown indicated diagrammatically the manner of connecting the several motors with a central controller station. As shown in said figure, N designates the controller station or house. Four motors P P^1 P^2 P^3 are indicated diagrammatically in said Fig. 15 which shows an arrangement for operating two bridges each having two leaves such as are illustrated in Figs. 1 and 2. Said motors are connected by feed wires p p^1 p^2 p^3 with the controller house or station, and the two motors on each side of the waterway are connected by common return wires p^4 p^5 with said controller station. The controlling mechanism located at the controller station may be of any suitable or preferred form and may be operated to start all of the motors at once to simultaneously lift or lower all of the leaves of the bridges, or may be operated to progressively open or close the several bridges. Where a number of bridges are located side by side, the latter construction is a desirable one especially when the bridge traffic is heavy, inasmuch as it shortens the time during which a particular bridge is required to be opened, it being unnecessary to hold all the bridges open until a boat has passed the last bridge of a series and conversely it not being required to open a given bridge of a series until the boat has reached that bridge.

My invention includes improved features

of construction in the counterweights with which bascule bridges are usually provided for the purpose of counterbalancing the same.

First, referring to the general arrangement of the counterweight, the same, as shown in Figs. 1, 2, 3, 9, 10 and 12 of the drawings, consists of a transversely arranged counterweight E which is attached to the rear ends of and extends between the trusses, and occupies at its ends the spaces between the upper ends of the rolling segments and rear extensions of the upper chords of the trusses.

In Figs. 7 and 8 are shown two vertically arranged counterweight sections E^1 E^1 which are located in the planes of the trusses between the upper ends of the rolling segments and the upper chords.

The transverse counterweight E affords a transverse brace by which the trusses are rigidly connected with each other at their rear ends. The bridge illustrated being a "through" bridge, said transverse counterweight E is located at a height above the bridge floor sufficient for the passage of traffic beneath it.

As a further improvement in the construction of a counterweight, my invention includes the idea of a metal supporting member, reinforced and strengthened by a filling or body of concrete or like material adapted to be applied or inserted in a plastic state and allowed to harden; the composite structure of metal and concrete affording the necessary weight and at the same time possessing the strength and rigidity necessary for its purpose.

Both the lateral and transverse counterweights E^1 and E referred to consist of box-like structures of metal, rigidly connected with the span trusses and provided with fillings of concrete. This construction in a counterweight has the general advantage of providing the necessary weight with the use of materials much cheaper than metal, while at the same time the inclosure may be made relatively light in structure and the concrete filling when introduced therein in a plastic state and allowed to harden, is adapted to give stiffness and rigidity to the counterweight structures.

Fig. 7 shows in end view lateral counterweights E^1 E^1 located in the planes of the trusses. The trusses in this instance are connected by a transverse frame E^2, extending between the said counterweights. Each counterweight E^1 as shown in the sectional view Fig. 8, consists of a box-like inclosure of sheet metal, comprising side plates e e and marginal plates e^2 e^2. The box-like inclosure thus formed is secured to the upper end of the rolling segment, and to the rearward extension of the upper truss chord, in any suitable manner. The said side plates e e are connected with each other by transverse bolts e^1 acting to prevent the spreading apart of the said side plates when the inclosures are filled with cement or concrete in a plastic condition. When completed the space within the box is filled with a solid body e^3 of cement or like material which retains its shape and serves to give rigidity to the inclosure.

In Figs. 9 and 10 is shown a counterweight E which extends transversely between the trusses of the bridge, and also occupies the planes of the trusses; the counterweight structure in this instance serving to afford a rigid connection between the two trusses. As shown in said Figs. 9 and 10, the counterweight comprises a box-like structure embracing front and rear walls e^4 e^5, top and bottom walls e^6 e^7, and end plates e^8 e^8 (one of which is shown in Fig. 9) located in the planes of the outer faces of the trusses. Angle bars e^9 e^9, employed to give rigidity to the end portions of the counterweight structure and to afford a sufficiently rigid connection between the rolling segments and the upper chords of the truss, are shown as extending through the ends of the inclosure.

Tie rods e^{10} extend horizontally through the counterweight from end to end thereof, other tie rods e^{11} and e^{12} extend vertically and horizontally through the same, said tie rods being attached at their ends to the box walls. Said tie rods hold the walls from spreading and serve to strengthen the body of concrete in which they are embedded. The counterweight made as described may be easily and cheaply constructed, the metal structure being completed and the cement or concrete inserted therein in a plastic condition, and then allowed to harden.

The counterweight is preferably provided with one or more pockets E^3 (Fig. 10) which are designed to receive additional counterweight material in order to effect final counterbalanced adjustment of the bridge leaf. The said pockets E^3 E^3 are shown provided with a covering plate e^{13} constituting part of the front wall of the box. The plate e^{13} is made removable, being held in place by retaining bars e^{14} e^{14} engaging the upper and lower margins thereof, and fastened to the front wall of the counterweight box in any suitable manner.

As a further improvement in a rolling lift bascule bridge, I make the rolling segments thereof of a metal member reinforced or strengthened by a body of cement or concrete which is applied to the metal member in a plastic condition. The cement or concrete as applied to the metal part of the segment not only serves to make the same stronger and more rigid, but also acts as a counterbalancing weight bringing the center of gravity of the leaf nearer its rear end. The metal member or frame of a rolling segment to which cement or concrete is so applied may be made of any desired form or structure.

In Figs. 5 and 11, I have shown in cross section a hollow or box form of rolling segment, the interior of which is filled with a body of cement or concrete b. The main part or body of said segment structure comprises parallel, vertical side plates b^1 b^1, an upper plate b^2 and a convexly curved lower or bearing plate b^3. The side walls of said segment are shown as tied together by bolts or rods b^4 b^4 extending through and embedded in the concrete body.

In Fig. 16 I have shown a somewhat different form of rolling segment, embracing a metal member reinforced by cement or concrete. In this instance the rolling segment is, in its cross sectional form, like an I beam, having the lateral spaces at the sides of its central web filled with masses b^5 b^5 of cement or concrete. The main frame or body of the segment structure comprises a central, vertical plate or web b^6, an upper marginal plate or member b^7 and a convexly curved plate b^8 which constitutes the lower member of the I beam and is convexly curved and forms the curved bearing member of the rolling segment. The connection between the web b^6 and plates b^7 and b^8 is shown as formed and reinforced by additional plates and angle bars in a familiar manner.

The masses b^5 b^5 of concrete are shown as tied together and to the web b^6 by means of bolts or tie rods b^9 b^9, inserted transversely through the web b^6. Flat plates or washers b^{10} b^{10} are shown as embedded in the outer faces of the masses of concrete b^5 b^5, and provided with holes through which the ends of the bolts b^9 b^9 pass; said plates serving to more securely hold the masses of concrete to the metal frame of the segment. As an additional means of reinforcing or strengthening the said masses b^5 b^5 of concrete and holding the same on the metal frame of the segment, I have shown tie rods b^{11} b^{11} as extending through the said masses of concrete, parallel with the web b^6 and transverse to the bolts b^9 b^9.

As a still further improvement in bridges of the character described, in which the supporting tracks for the rolling segments are formed by track girders, I make said track girders of metal members, reinforced or strengthened by cement or concrete applied thereto.

As illustrated in Fig. 5, which shows the track girder C in transverse section, said track girder is made of hollow or box form and its interior is filled by a mass or body c^1 of cement or concrete. The metal member of said track girder, as illustrated in said Fig. 5, is formed by the track plate c which, as hereinbefore described, constitutes the upper longitudinal member of said track girder, two parallel vertical side plates c^2 c^2 and a bottom longitudinal member c^3. It is to be understood, however, that the track girder reinforced or strengthened by the cement or concrete as set forth may be variously formed or constructed. For instance, instead of box forms of girder shown in Fig. 5, an I beam form of girder may be employed, such as is shown in cross section in Fig. 17. In this instance the track girder consists generally of the track plate c which forms the upper longitudinal member of the girder, a lower longitudinal plate or member c^3 and a central vertical web or plate c^4 rigidly connected at its top and bottom margins with the top and bottom plates or members c and c^3. The said web or plate c^4 is connected with the top and bottom plates c c^3 by connecting and reinforcing plates and angle bars, as illustrated in said Fig. 17.

The spaces between the plates c c^3 at the sides of the web or vertical plate c^4 are filled by masses c^5 c^5 of cement or concrete which are held in place and firmly secured to the metal body of the girder by means of a plurality of transversely arranged bolts or tie rods c^6 c^6 which pass at their ends through and are engaged with vertical bars c^7 c^7 which extend along the outer faces of the said masses c^5 c^5 of cement or concrete. The said bolts or tie rods c^6 c^6 pass through holes in the central plate or web c^4. The metal body of the girder together with the tie rods or plates c^6 and the upright bars c^7 c^7 in this instance constitute a metal frame to which the cement or concrete is applied when in a plastic condition and which, with the mass of cement or concrete, forms a composite structure affording a track girder having a high degree of strength and rigidity and also great durability because the metal body of the girder is to a considerable extent protected from rust or corrosion by the cement or concrete applied thereto.

The features of construction relating to the center lock, shown and described, constitute the subject-matter of a divisional application, Serial Number 529,845, filed November 26th, 1909.

I claim—

1. In a skew bascule bridge, the combination of two swinging leaves which meet each other at their outer ends when closed, main supports on which said leaves are movably sustained at their rear ends, auxiliary piers, one for each leaf, located one at one side and the other at the opposite side of the bridge, and in position to engage the leaves when closed at points between the rear and forward ends of the same, and locking means at the meeting ends of said leaves.

2. In a skew bascule bridge, the combina-

tion of two swinging leaves, each comprising two longitudinal trusses, and rolling segments attached to the rear ends of said trusses, main supporting tracks in which said segments rest and roll, auxiliary piers located one at one side and the other at the other side of the bridge in position for engagement with one truss of each leaf at a point between the ends of said truss, and locking means for connecting the meeting ends of said leaves.

3. In a skew bascule bridge, the combination of two swinging leaves each comprising two longitudinal trusses, main supports on which said leaves are movably supported at their rear ends, and two auxiliary supporting piers, located one at one side and the other at the other side of the bridge, in position to engage one of the trusses of each leaf when closed at points between the ends of said trusses, each of said trusses which engages and is supported by an auxiliary pier having on its forward end a locking projection adapted for sustaining engagement with the forward end of the truss of the other leaf which is unsupported by an auxiliary pier.

4. In a rolling lift bascule bridge, the combination with a swinging bridge leaf, of actuating mechanism therefor comprising an operating shaft on the leaf, through which rising and falling movement is given to the leaf, a rotative driving shaft mounted on a stationary support, and driving connections between said driving shaft and the operating shaft on the leaf, comprising a shaft and sleeve having splined connections with each other, and oscillatory bearings for said shaft and sleeve.

5. In a rolling lift bascule bridge, the combination with a bridge leaf of actuating mechanism therefor, comprising a rotative operating shaft on the leaf, a rotative driving shaft mounted in stationary bearings, driving connections between said driving and operating shafts embracing a shaft and sleeve having splined connection with each other, said shaft and sleeve having bearings mounted to turn on parallel horizontal axes, and gearing connecting said driving and operating shafts with said shaft and sleeve, said gearing embracing gear wheels on the shaft and sleeve and gear wheels mounted concentrically with the said horizontal axes of the bearings.

6. In a rolling lift bascule bridge, actuating mechanism for the bridge leaf comprising a driving shaft mounted in stationary bearings, an operating shaft mounted on the leaf and driving connections between said shafts comprising a shaft and sleeve having splined connection with each other, bearings for said shaft and sleeve, mounted one on the leaf and the other on a stationary support, said bearings being adapted to swing on horizontal axes and in the same vertical plane.

7. In a rolling lift bascule bridge, actuating mechanism for the bridge leaf comprising a driving shaft mounted in stationary bearings, an operating shaft mounted on the leaf, and driving connections between said shafts comprising a shaft and a sleeve having splined connection with each other, oscillatory bearings for said members, mounted one on the leaf and the other in a stationary support, said bearings being adapted to swing on horizontal axes and in the same vertical plane, and driving connections between said driving and operating shafts, and the said shaft and sleeve, comprising bevel gear wheels mounted to turn on horizontal axes concentric with the axes of rotation of the said bearings and bevel gear wheels affixed to said shaft and sleeve.

8. In a rolling lift bascule bridge actuating mechanism for the bridge leaf comprising a shaft and a sleeve having splined connection with each other, oscillatory bearings for said shaft and sleeve mounted on the bridge leaf and on a stationary part and adapted to swing on horizontal axes, a horizontal shaft supporting the bearing for said sleeve, beveled gear wheels on said sleeve and shaft, a beveled gear wheel mounted on the bridge leaf, concentric with the pivotal axis of the oscillatory shaft bearing, a horizontal hollow shaft mounted in stationary bearings and surrounding the shaft which supports the said sleeve bearing, a beveled gear wheel on said hollow shaft intermeshing with the beveled gear wheel on said sleeve, driving connections between said driving shaft and said hollow shaft and driving connections between said beveled gear pinion on the bridge leaf and said operating shaft on the leaf.

9. In a rolling lift bascule bridge, the combination with a bridge leaf, of actuating means for the leaf comprising a driving shaft mounted in stationary bearings, an operating shaft on the leaf, an oscillatory shaft and sleeve having splined connection with each other, an oscillatory hanger provided with a bearing for the said oscillatory shaft, a horizontal pivot stud on the bridge leaf affording pivotal support for said hanger, a gear pinion on said oscillatory shaft, a beveled idler gear pinion mounted on said pivot stud and intermeshing with that on the oscillatory shaft, a connecting shaft located on the bridge leaf in the same vertical plane with the oscillatory shaft, a pinion on said connecting shaft intermeshing with the idler gear wheel, an oscillatory bearing for said sleeve mounted to turn on a horizontal axis, a beveled gear pinion on said sleeve, a beveled gear wheel mounted concentrically with said oscillatory sleeve bearing, and driving connections between

said last named gear wheel and said driving shaft.

10. In a rolling lift bascule bridge, the combination with a bridge leaf, of actuating mechanism therefor, comprising a driving shaft mounted in stationary bearings, an operating shaft on the bridge leaf, an oscillatory shaft mounted on the bridge leaf and adapted to swing in a vertical plane, an oscillatory sleeve having splined connection with said oscillatory shaft and adapted to slide endwise thereon, an oscillating bearing on the bridge leaf for said oscillatory shaft, a connecting shaft mounted on the bridge leaf in the same plane with said oscillating shaft, beveled gear wheels on the adjacent ends of said oscillating shaft and connecting shaft, an idler beveled gear wheel on the bridge leaf mounted concentrically with said oscillating shaft bearing and intermeshing with the gear wheels on the oscillatory and connecting shafts, a horizontal hollow shaft mounted in stationary bearings and having operative connection with the driven shaft, a horizontal shaft mounted in said hollow shaft, an oscillatory bearing for said sleeve attached to said horizontal shaft and intermeshing beveled gear wheels on said hollow shaft and sleeves.

11. In a bascule bridge, a swinging bridge leaf embracing a floor frame, two longitudinal trusses which extend above the floor frame, and a counterweight extending transversely between the upper parts of the trusses and constituting an overhead brace for rigidly connecting the upper parts of said trusses; said counterweight consisting of a box-like metal member rigidly attached at its ends to the trusses, and a filling of concrete inserted in a plastic state into said box-like member and forming therewith a rigid, composite structure.

12. In a bascule bridge, a swinging bridge leaf provided with rolling segments, said rolling segments consisting of a metal frame or body, tie rods or bolts connected with the same, and a filling of cement or concrete.

13. In a bascule bridge, a swinging bridge leaf provided with rolling segments, constructed of metal reinforced by cement or concrete.

14. In a bascule bridge, a swinging bridge leaf provided with rolling segments, said rolling segments consisting of hollow metal inclosures provided with a filling of cement or concrete.

15. In a bascule bridge, a swinging bridge-leaf provided with rolling segments, said rolling segments consisting of metal inclosures provided with tie rods extending therethrough, and a filling of cement or concrete.

In testimony that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 1st day of July A. D. 1907.

ALBERT H. SCHERZER.

Witnesses:
G. R. WILKINS,
D. E. MARMON.