confined to suitable bearings $k$, secured to the beams $A A$, that while it can be turned easily it is incapable of vertical movement. This screw may be operated by any suitable mechanism, but we prefer to operate it from a central point on the pivot-bridge, and to connect the operating mechanism by means of a horizontal shaft extending along the bridge beneath the ties, one end of the shaft being geared by bevel-wheels to the screw $K$ at one end of the bridge, and the opposite end to a similar screw at the opposite end of the bridge, so that the knee-joint links, at all four corners of the bridge, may be operated simultaneously from one point. The outer ends of the rails $a a$, at each end of the bridge, admit of being raised and lowered by the same mechanism which operates the knee-joints. Thus the rails $a a$ in Fig. 1 are in the same position by rods $y$ to the rods $I I$, and these rails are adapted to chairs $d d$, which are secured to the permanent roadway or permanent part of a bridge, and which receive the ends of the permanent rails $b b$ of the track, the chair thus insuring the coincidence of the rails of the shoes $d d$ of the permanent track.

As seen in the drawing, the bridge is supposed to be closed, and free for the passage of trains, the rollers $p$ at the lower end of the knee-joint links at each corner of the bridge bearing in a cavity in the top of a plate $T$, secured to the foundation or pier; and the pins of the knee-joint links being in the same vertical line, the links afford a steady support for the bridge at each of its four corners. When it is necessary to swing the bridge round, the screw $K$, at each end of the bridge, is turned so as to elevate the rails. This consequently draws the rods $G$ and $I$ in the direction of the arrows, and therefore so acts on the knee-joint links as to elevate the rollers $p$ in their guides; and this is continued until the bridge is in the first instance lowered and supported on its centre pivot only, and afterward until the rollers are clear of their bearings. Simultaneously with this movement of the knee-joint links, the outer ends of the rails, owing to their connections with the rods $I I$, were elevated clear of the chairs $d d$, as seen in Fig. 4, and consequently the bridge is free to be turned on its pivot. In restoring the bridge to its original position, it is turned round until the rollers $p$ of the knee-joint links are above the cavity of the foundation-plate $t$. It is very rarely, however, that the bridge can be arrested in its movement at a point where the said rollers are directly above the centre of the said cavity; but as soon as the screws $K$ are operated to straighten the knee-joint links, and the rollers $q$ begin to bear upon the plates $t$, the weight on the rollers will induce them to descend into the cavities of the plates, and hence as the straightening of the knee-joint links is continued, the bridge will be slightly turned, until the rollers have arrived at the most depressed portion of the cavities in the plates, and there remain while the straightening of the knee-joint links is continued until their coincidence with the rails of the permanent track is thereby assured. The accidents which have frequently occurred through the non-coinciding of the rails of a pivot-bridge with those of the permanent track are thus prevented.

Although we have shown and described a pivot-bridge constructed in a manner which we deem most appropriate, it should be understood that our improvements are applicable to any pivot-bridge. A change in the operating mechanism may be demanded in a bridge constructed in a manner differing from that described, but the principal features may remain; these features being the knee-joint links, forming corner-supports which can be easily withdrawn, and the plates $t$, which render the bridge self-centering.

We claim as our invention—
1. The combination, with a pivot-bridge substantially as described, of knee-joint supports and the mechanism described, or any equivalent to the same, for operating the said joints.
2. In combination with a pivot-bridge having movable links as supports, we claim plates $t$, constructed, substantially as described, so as to render the bridge self-centering.

PLATE No. 11.

DESIGN G.—This is our usual pattern of highway bridge, with floor beams of iron, which may or may not be trussed, according to the available depth below roadway. It is constructed exactly like a railway bridge, except in the floor system, and is calculated to sustain a load of from 1500 to 2500 pounds per lineal foot, with a friction of safety of 5. Teams may cross these bridges at full speed without doing any mischief.

PLATE No. 12.

DESIGN I is an iron highway bridge, to be used for roads crossing over railways. Fig. 45 is intended for points where abutments are already built, or where, from the railway being on a curve, it is not desirable to obstruct the view. On the right side of Fig. 45 a more economical construction than the ordinary stone abutment is suggested.

PLATE No. 13.

DESIGN K shows our method of constructing wrought-iron piers for bridges, viaducts, etc. They are made of four Phoenix columns, braced together as shown, and secured at the joints by our patent system of connections.

As the lengths and weights of spans increase, we increase the dimensions of the columns and braces, but the same general form of construction is followed for all lengths of spans.

PLATE No. 14.

DESIGN L shows a bridge on iron piers, intended for the crossing of a small stream or road, where good stone for masonry cannot easily be got. The piers can be built of split boulders, or of concrete, if stone cannot be had; and, as they are buried in the embankments, concrete will answer as well as stone. These piers can be copped with stone or iron.

DESIGN M shows a wrought-iron viaduct resting on cast-iron screw piles, and suitable for crossing the wide river bottoms of the western and southern States, where stone is scarce, and where a wide water-way must be permanently maintained.