E. N. & R. E. SPAULDING.

CROSSOVER FOR CONCRETE GIRDER FRAMES.

APPLICATION FILED MAY 26, 1908.

929,890.

Patented Aug. 3, 1909.

3 SHEETS—SHEET 1.

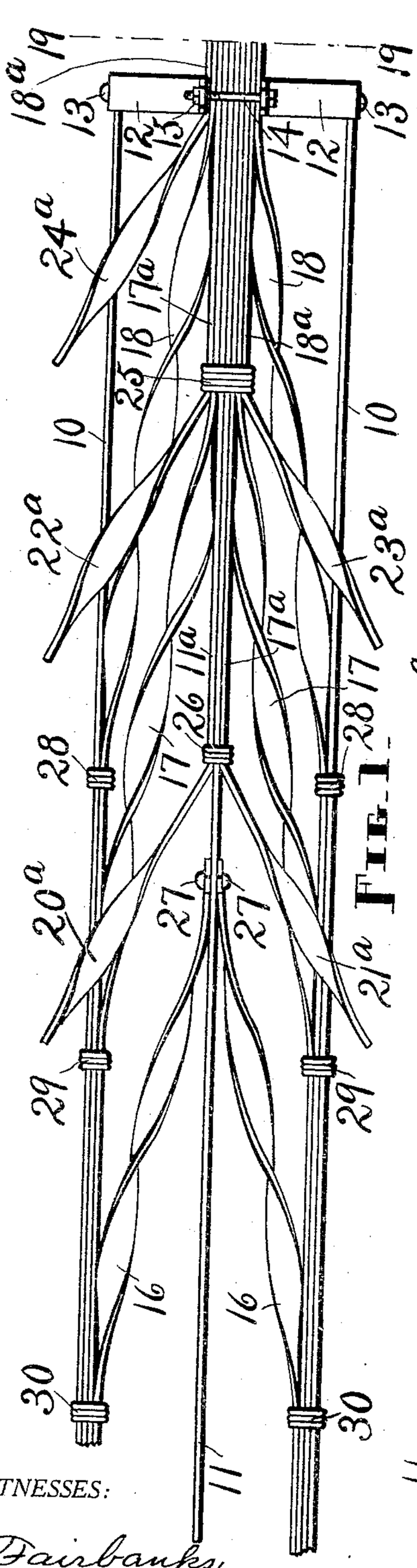

FIG. 1.

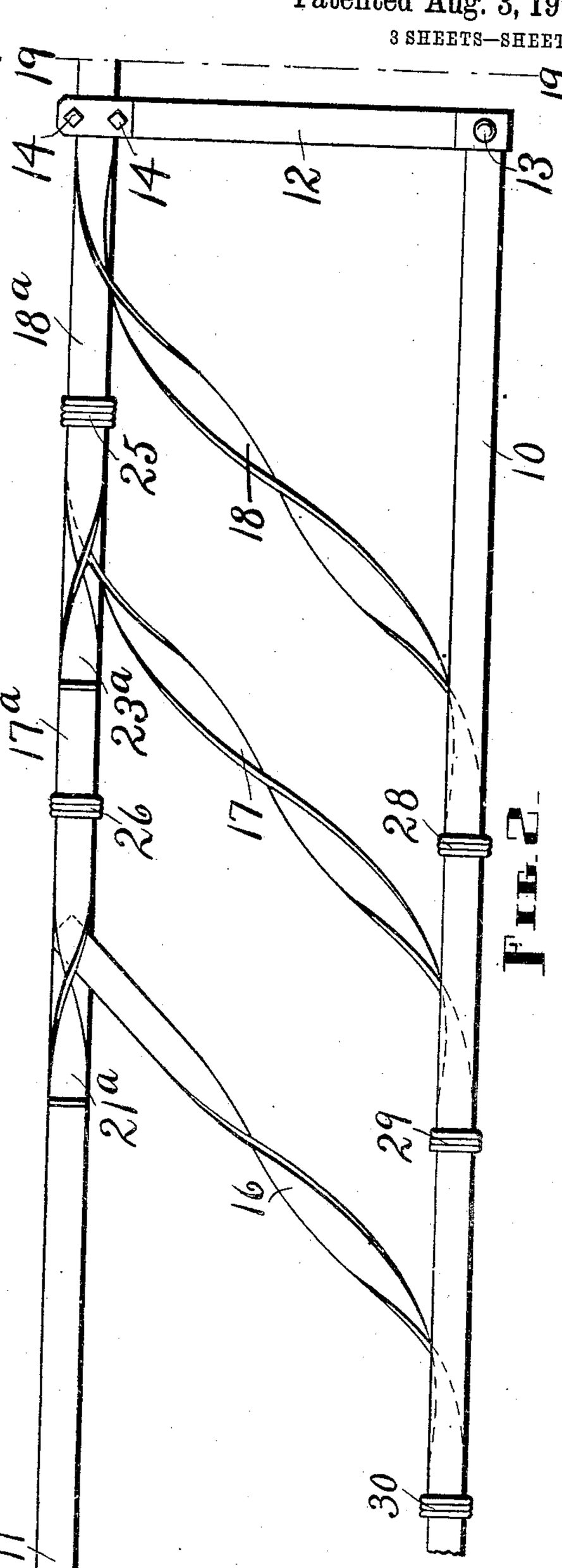

FIG. 2.

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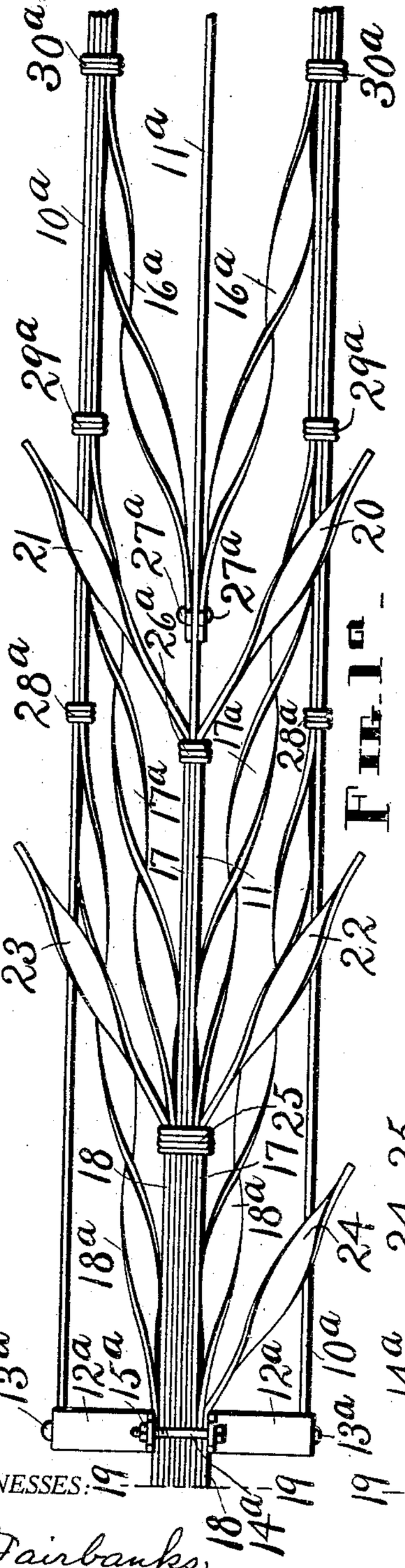

FIG. 1a.

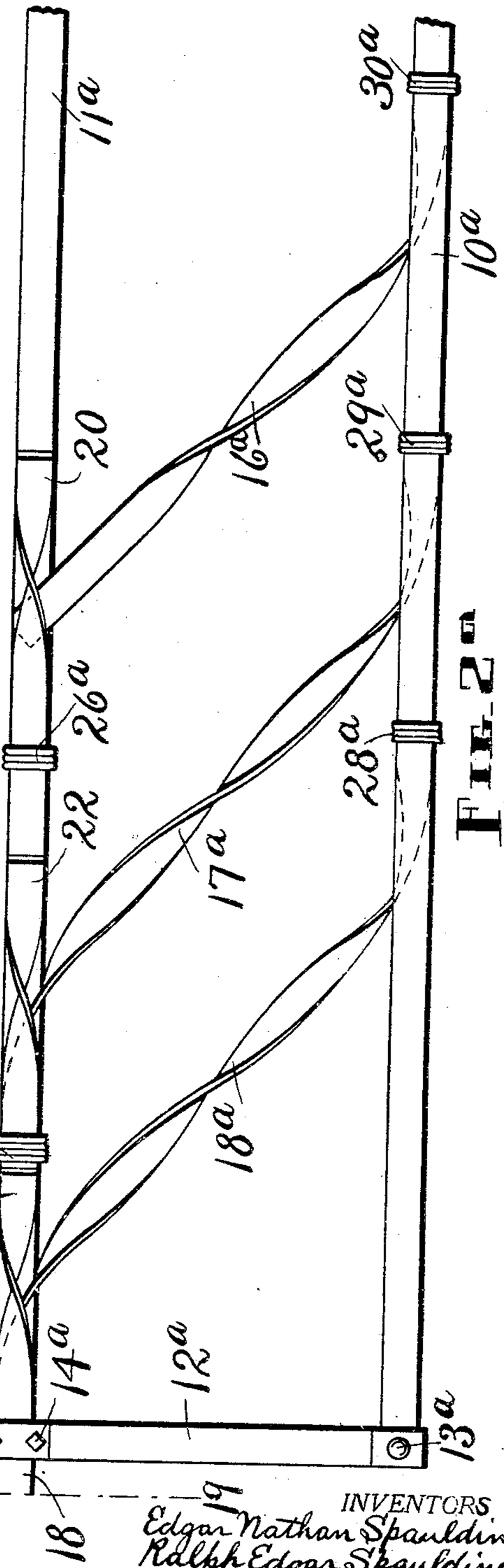

FIG. 2a.

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3 SHEETS—SHEET 3.

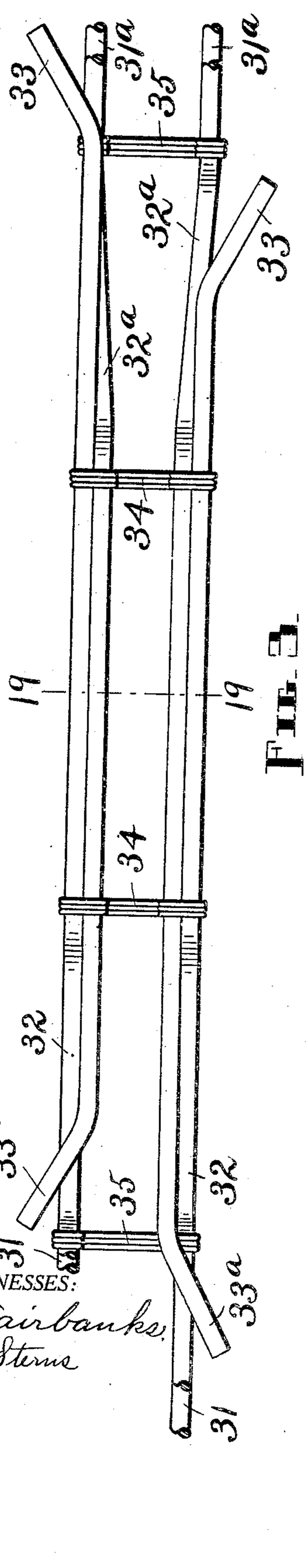

FIG. 3.

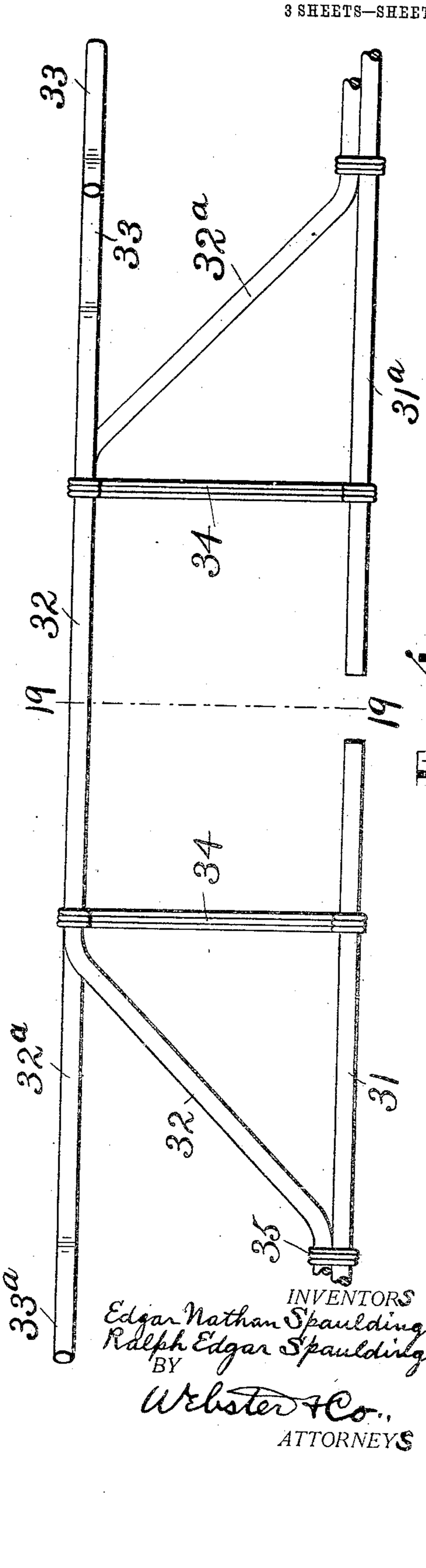

FIG. 4.

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UNITED STATES PATENT OFFICE.

EDGAR NATHAN SPAULDING AND RALPH EDGAR SPAULDING, OF SUFFIELD, CONNECTICUT.

CROSSOVER FOR CONCRETE GIRDER-FRAMES.

No. 929,890. Specification of Letters Patent. Patented Aug. 3, 1909.

Application filed May 26, 1908. Serial No. 435,156.

To all whom it may concern:

Be it known that we, EDGAR NATHAN SPAULDING and RALPH EDGAR SPAULDING, both citizens of the United States of America, and residents of Suffield, in the county of Hartford and State of Connecticut, have invented a new and useful Crossover for Concrete Girder-Frames, of which the following is a specification.

Our invention relates to improvements in what are commonly known as steel frames for concrete girders, and more particularly to the parts called cross-overs of such frames that are required when the girders in which the frames are embedded pass over columns or other supports, and consists of certain peculiar lapped continuations of members which enter into the construction of alining frames, such continuations being bound together so that two or more alining frames become to all intents and purposes as one, as hereinafter set forth.

Our cross-over is located above the base of the frame so as to provide for tensile stress over the support and take the tension in the upper part of the girder or beam caused by the negative bending moment.

Two kinds of bonds in reinforced concrete construction are depended upon, namely—mechanical and physical, and both are usually present although one or the other generally predominates; in this invention provision is made whereby the physical bond is dominant as it is believed that a stronger construction and better results are thus obtained. To augment our physical bond we bend outward certain of the cross-over members, as will presently appear, to increase the number of anchorages for the metal in the concrete, it being understood that this kind of bond resides in the union between the metal and concrete, while the other kind, the mechanical, resides in the bolting, riveting, wiring, or otherwise fastening together of the metallic members themselves.

The objects of our invention are, first, to provide a strong, durable, and efficient device of the class specified above, by means of which what amounts to a continuous frame over a support or supports is produced, and this without resorting to loose and expensive connections; second, to be able properly to combine in such a frame the two kinds of bonds; third, to afford eminently practical means for obtaining not only the necessary amount but an ample amount of steel in cross-section over supports, and, fourth, to produce a cross-over which is readily adaptable to the various conditions that must be met in concrete structural work.

This invention is well adapted for use with a triangular frame made up of bottom tension bars, a top stay bar, and combination shear and tension bars, such as is set forth in United States Letters Patent, No. 887,863, issued to us May 19th, 1908, the top stay bars and certain of the combination shear and tension bars of two adjacent frames being continued to form the cross-over. This construction will resist all stresses developed up to its full capacity, the longitudinal members resisting the tensile stresses between supports, the diagonal members resisting the shearing stresses, and the continuations resisting the negative stresses over supports.

We attain the objects and secure the advantages above pointed out by the means illustrated in the accompanyng drawings, in which—

Figures 1 and 1ª combined are a plan view of a cross-over fabricated out of two triangular frames; Figs. 2 and 2ª combined, a side elevation of the same; Fig. 3, a plan view of a cross-over in a different type of frame, and, Fig. 4, a side elevation of the latter.

Similar figures refer to similar parts throughout the several views.

Adjacent end portions of two triangular frames are represented in the first four views, each of such portions consisting of the same number of parts as the other and similarly arranged, both in the construction of the frames themselves and in the formation of the cross-over which latter is made up of certain of said members. The left-hand frame members comprise two bottom tension bars 10 spaced apart, a top, stay and tension bar 11 located above the longitudinal center of the space between said bars 10, tie-bars 12—12 at the ends, one pair only appearing, having their bases riveted at 13—13 to the bars 10 and their upper terminals connected by bolts 14—14 and nuts 15—15, said bolts being above and below said top bar and the other bars presently to be described, all of which bars are closely confined between said upper terminals of the

tie-bars by means of the bolts and nuts, and a plurality of combination shear and tension bars three pairs of which are shown at 16, 17 and 18. The right-hand frame members shown comprise two bars 10^a, a bar 11^a, tie-bars 12^a held in place by rivets 13^a, bolts 14^a and nuts 15^a, and bars 16^a, 17^a, and 18^a, all similar to corresponding parts in the left-hand frame. The combination shear and tension bars are obliquely arranged and they are preferably twisted. For a more detailed description of a frame of this type attention is again called to the Letters Patent hereinbefore mentioned.

In order to form a cross-over between the aforesaid frames above a support, the vertical transverse center of which latter is indicated by the broken lines 19—19, and to securely bind said frames together, and to make a connection that will firmly unite with the concrete the top bars 11 and 11^a are carried respectively over said center, through the eyes or loops formed by the upper terminals of the tie-bars 12^a and 12 and the bolts 14^a and 14, and alongside of each other for some distance, when each takes an oblique course, the oblique terminal of the bar 11 being represented at 20 and the oblique terminal of the bar 11^a being represented at 20^a; one of the combination shear and tension bars 17 is carried along at the top on the outside of the bar 11^a across the center 19 and turns off obliquely at 21 opposite the terminal 20; the bar 17^a on the same side with said last-mentioned bar passes at the top along the upper horizontal part of the latter over the center and ends at 22^a; the second bar 17^a passes at the top along the bar 11 and terminates at 21^a opposite the terminal 20^a; the second bar 17 passes at the top along the upper horizontal part of the bar 17^a on the same side and terminates at 22; outside of the upper horizontal portion of the bar 17^a on one side is the corresponding portion of the bar 18 on that side, said bar 18 having an oblique terminal 23 like the others; on the opposite side against the horizontal portion of the bar 17 is the corresponding portion of the bar 18 on the same side with an oblique terminal 23^a, the terminals 22^a and 23^a being opposite each other and the terminals 22 and 23 being opposite each other, and the horizontal parts of the two remaining bars 18 and 18^a respectively bear against the other bars 18^a and 18 and terminate at 24 and 24^a.

The oblique terminals 20, 20^a, 21, 21^a, 22, 22^a, 23, 23^a, 24 and 24^a are for anchorage purposes and such parts are preferably twisted in order to insure a perfect and secure union between them and the concrete.

All of the cross-over members are confined between the tie-bars and the bolts which pass therethrough over and under such members, as already noted. The bars 11, 11^a, 17 and 17^a are all bound together at two places by means of wire wrappings 25. The bars 11, 11^a and 17^a are bound together by means of wire wrappings 26, and the bars 11^a, 11 and 17 by means of similar wrappings 26^a.

The combination shear and tension bars 16 and 16 respectively have their tops riveted at 27 and 27^a to the bars 11 and 11^a. The bars 18, 17, and 16 on each side are provided with horizontal bases which lie alongside of the corresponding bar 10 and of each other, wire wrappings 28, 29, and 30 being employed to fasten these members together, and the bars 18^a, 17^a, and 16 on each side are provided with the same kind of bases arranged in the same way and held in place by similar wrappings 28^a, 29^a, and 30^a.

From the foregoing description it will be plainly seen that this construction affords an exceedingly strong, practicable and efficient cross-over.

In the last two views end portions of two simple frames are illustrated, the one at the left consisting of two parallel rods 31 spaced apart in any suitable manner, and that at the right consisting of two similar rods 31^a. To form the cross-over above the support, broken lines 19—19 here again indicating the transverse vertical center of said support, we provide four more rods two of which, 32, are on the rods 31, and two, 32^a, on the rods 31^a, carry each pair of additional rods obliquely upward, lap those on one side by those on the other side, and bend their terminals obliquely outward at 33—33 and 33^a—33^a to form anchorable members. Wire wrappings 34—34 and 35—35 are employed to securely fasten the parts together. The rods 32 and 32^a constitute combination shear and tension members.

The lapped joints of the two constructions afford compact and rigid cross-overs, particularly well adapted for structures of this kind.

It is obvious that more or less than the number of lapped members herein shown may be used, and that the arrangement of the same may vary, according to the demands or requirements of different girders, also that other means for binding or connecting the lapped members may be adopted.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The combination, in a device of the class described, of parallel tension members spaced apart and out of contact at the ends, and oblique members having horizontal portions at their bases which are attached to said tension members and having horizontal portions at their upper ends which cross over the space that intervenes between adjacent ends of the tension members, lap by each other, and are fastened together side by side, such upper horizontal portions being

bent outward at their free terminals beyond the points where said portions are fastened together.

2. The combination, in a device of the class described, of parallel tension members spaced apart and out of contact at the ends, top stay members which cross over the space that intervenes between adjacent ends of the tension members and lap by each other laterally, and oblique members having horizontal portions at their bases which are attached to said tension members and having horizontal portions at their upper ends which also cross over the aforesaid space between the tension members and lie against the sides of said stay members or of each other, the lapped portions of the stay members and of the oblique members being fastened together and the free terminals of all of such members being turned outward.

3. The combination, in a device of the class described, of parallel tension members spaced apart and out of contact at the ends, top stay members which cross over the space that intervenes between adjacent ends of the tension members and lap by each other laterally, oblique members having horizontal portions at their bases which are attached to said tension members and having horizontal portions at their upper ends which also cross over the aforesaid space between the tension members, such upper horizontal portions being of different lengths with the longest lying against the sides of said stay members and the shorter ones lying against the sides of their companions, and means to fasten together the lapped portions of the stay members and said upper horizontal portions of said oblique members.

4. The combination, in a device of the class described, of parallel tension members spaced apart and out of contact at the ends, top stay members which cross over the space that intervenes between adjacent ends of the tension members and lap by each other laterally, oblique members having horizontal portions at their bases which are attached to said tension members and having horizontal portions at their upper ends which also cross over the aforesaid space between the tension members, such upper horizontal portions being of different lengths with the longest lying against the sides of said stay members and the shorter ones lying against the sides of their companions, and means to fasten together the lapped portions of the stay members and said upper horizontal portions of the oblique members, said stay members and said upper horizontal portions of the oblique members extending beyond said fastening means and being bent outward to form anchorage terminals.

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