J. W. RIPLEY.

DOCK CONSTRUCTION.

APPLICATION FILED JULY 20, 1909. RENEWED AUG. 20, 1914.

1,227,670.

Patented May 29, 1917.

6 SHEETS—SHEET 1.

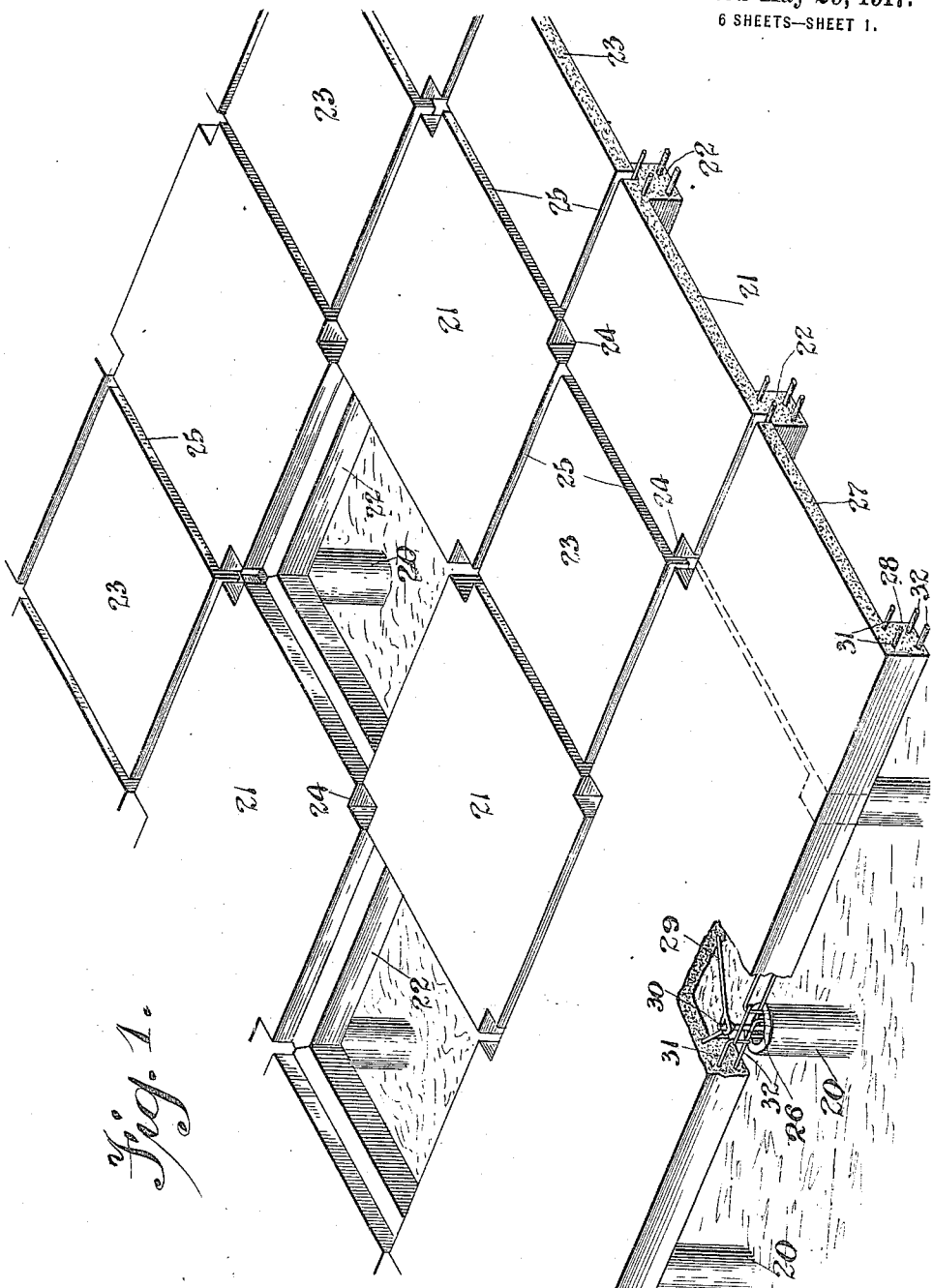


Fig. 1.

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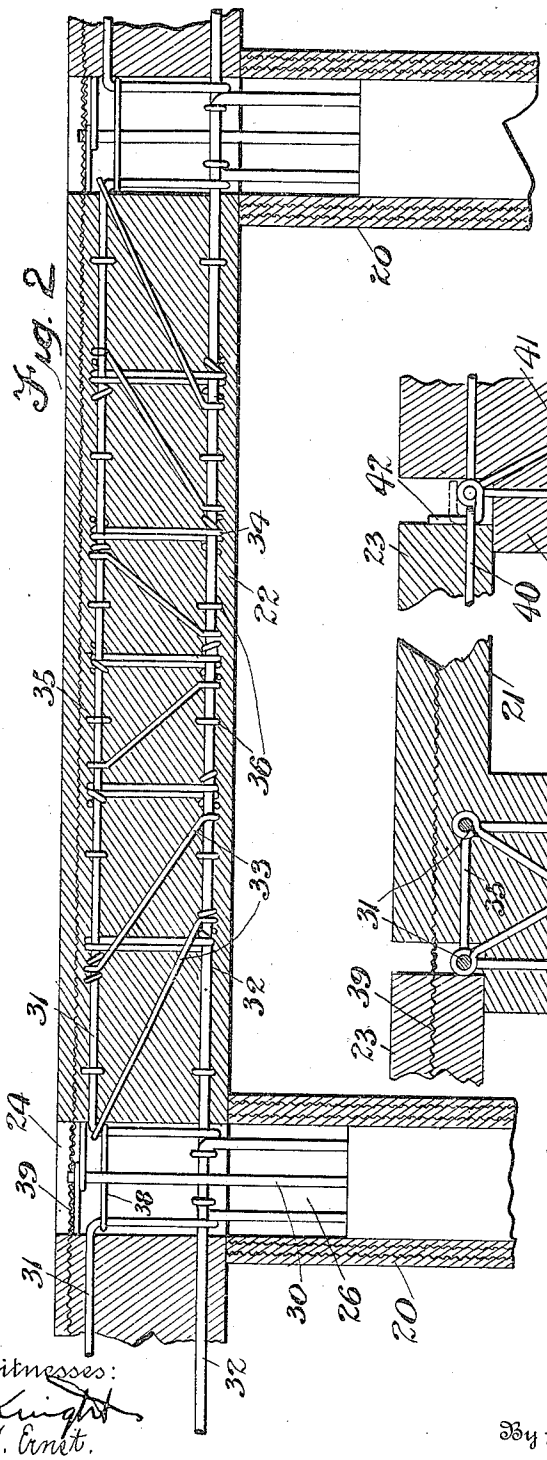


Fig. 2.

Fig. 4.

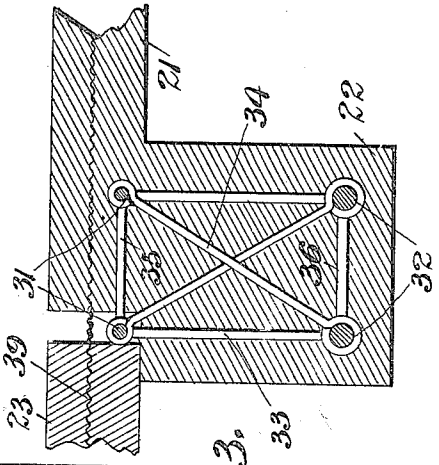


Fig. 3.

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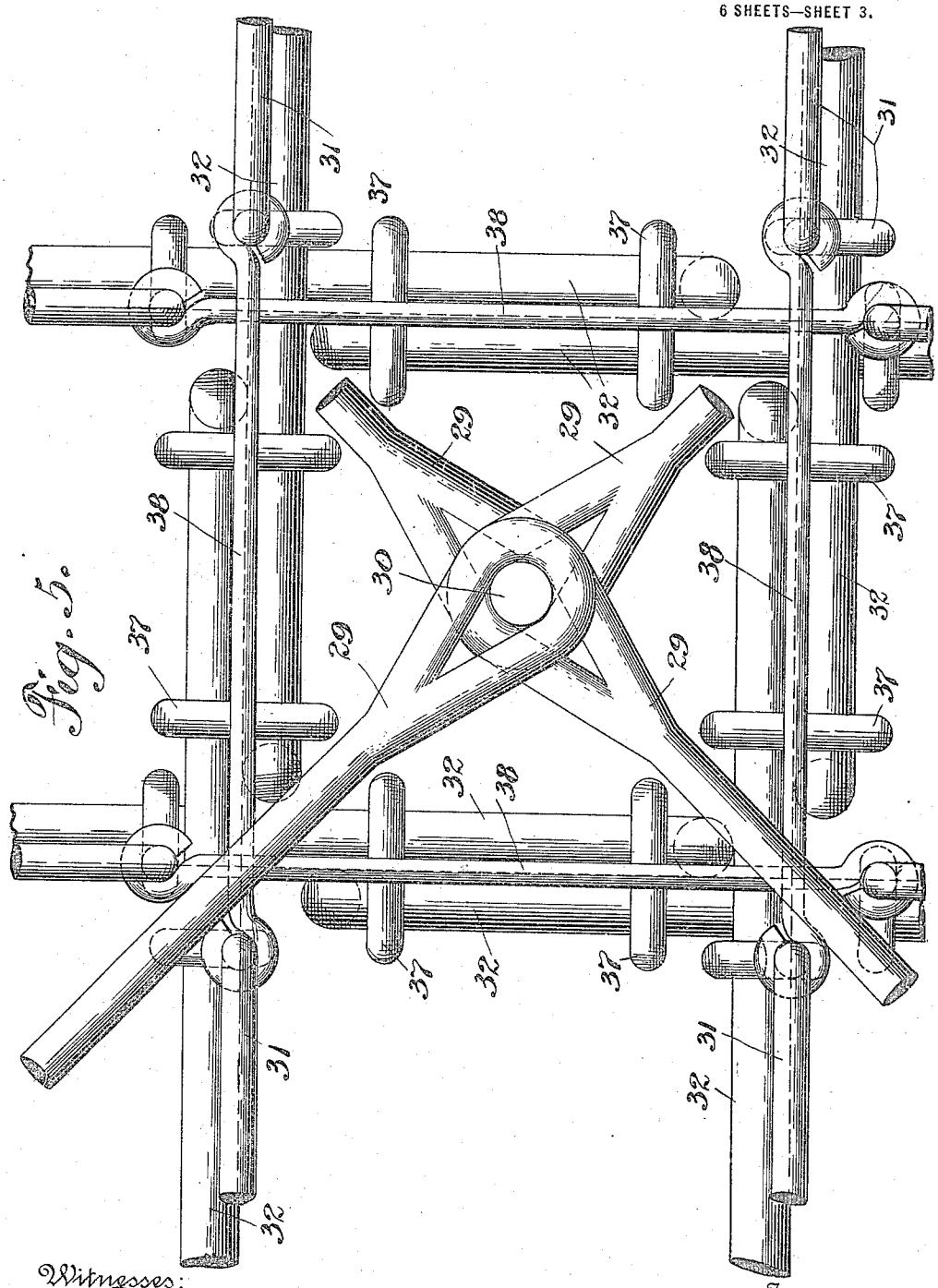


Fig. 5.

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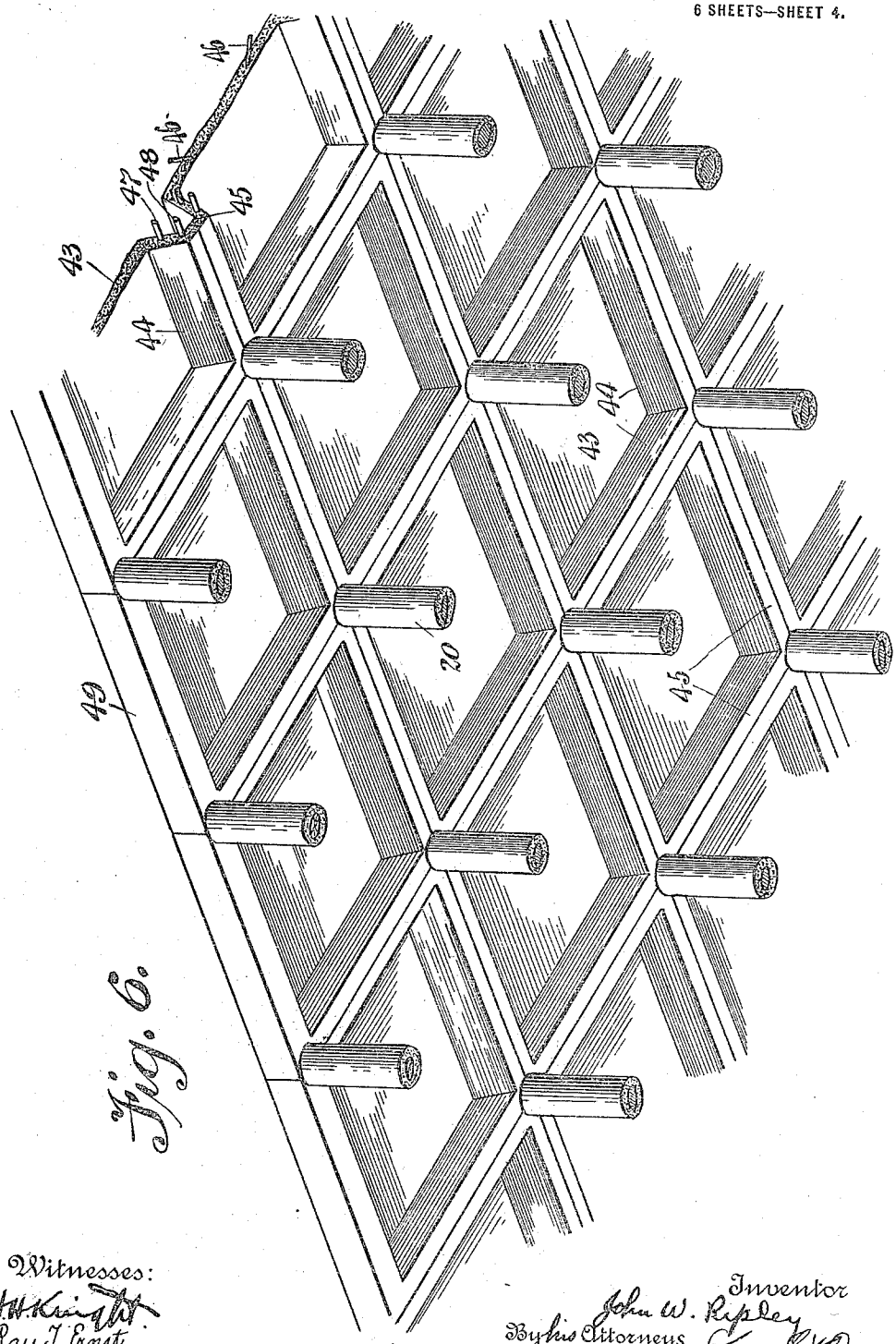


Fig. 6.

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DOCK CONSTRUCTION.

APPLICATION FILED JULY 20, 1909. RENEWED AUG. 20, 1914.

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6 SHEETS—SHEET 5.

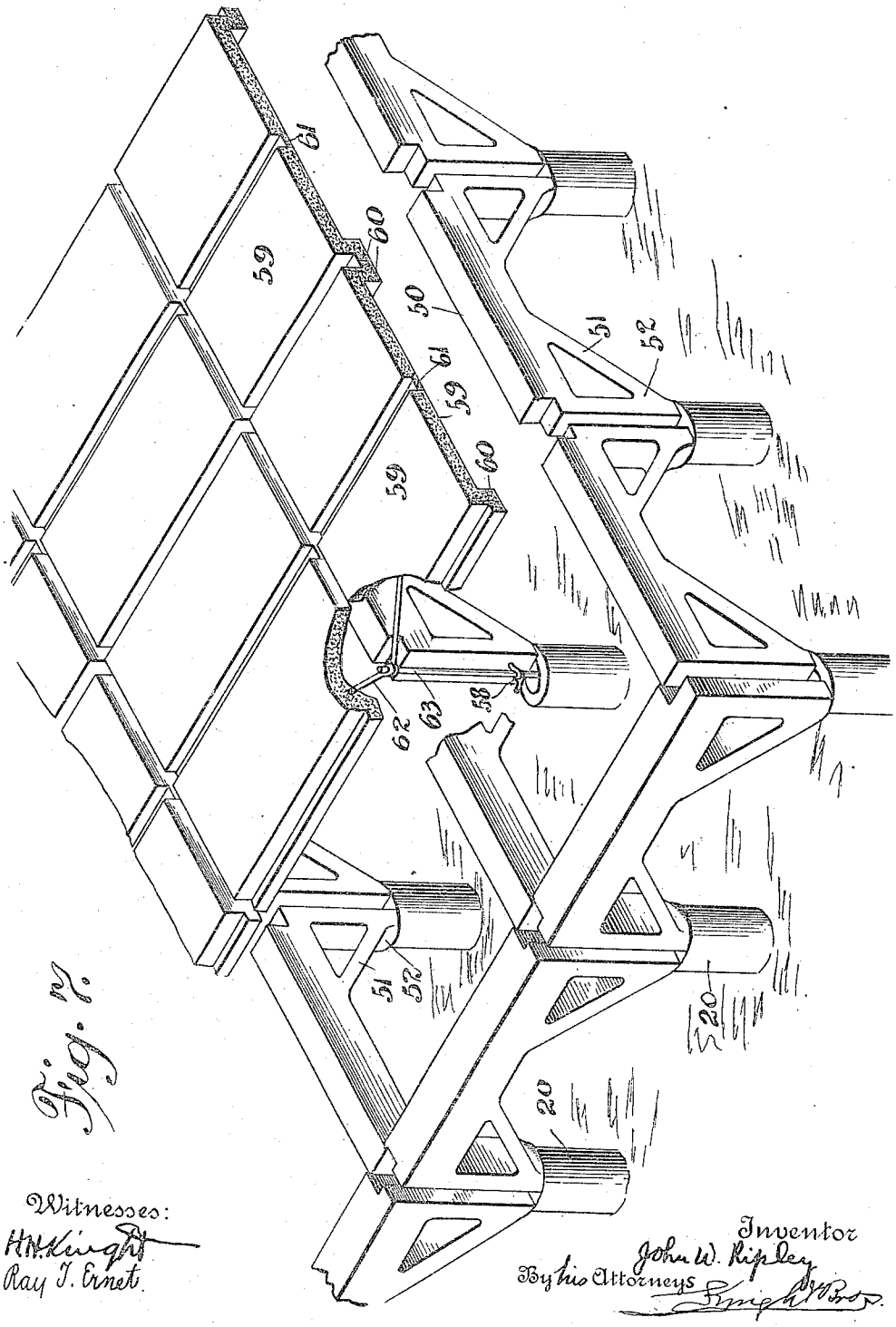


Fig. 5.

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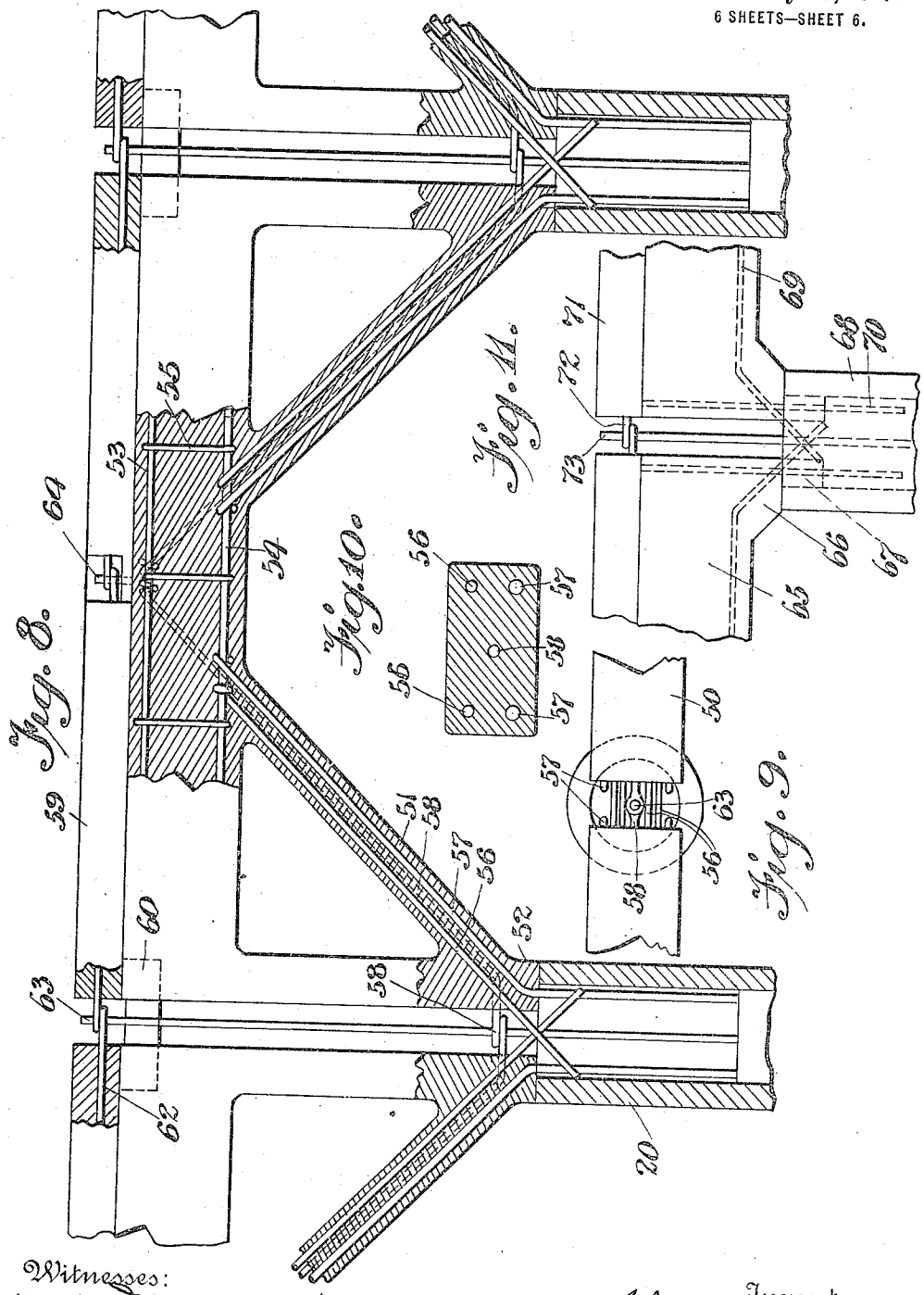
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6 SHEETS—SHEET 6.



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UNITED STATES PATENT OFFICE.

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DOCK CONSTRUCTION.

1,227,670. Specification of Letters Patent. Patented May 29, 1917.

Application filed July 20, 1909, Serial No. 508,666. Renewed August 20, 1914. Serial No. 857,769.

To all whom it may concern:

Be it known that I, JOHN W. RIPLEY, a citizen of the United States, and resident of Flushing, county of Queens, State of New York, have invented certain new and useful Improvements in Dock Construction, of which the following is a specification.

My invention relates to the construction of docks and more particularly to the construction of docks which are fire-proof and resistant to all detrimental agencies. Such docks have been constructed in concrete in various ways and my invention provides a novel form of construction by which the dock is produced from previously formed units connected and bonded together in such a way as to produce virtually a monolithic structure of reinforced concrete, which is permanent and resistant to fire, decay and the attack of sea worms and in fact all detrimental agencies.

In carrying out an invention in this particular field it is of course obvious that the details of construction may vary considerably, due to the diverse conditions which are encountered and the requirements to be met. I shall therefore not attempt to do more than illustrate certain prominent examples which embody the principles underlying my invention, it being understood that the engineer may embody these principles in constructions which as to detail may be quite different from the examples which I have selected as best illustrating my invention. The fundamental principle underlying my invention is the formation of the dock or similar structure from units which are previously formed and arranged in place, the connections being so made that the resulting structure is securely braced and strengthened in the directions of strain while at the same time being quite indifferent to fire, rust, decay, sea worms and other causes which tend to shorten the life of the dock. The units are supported upon a system of piling preferably but not necessarily, composed of wooden cores with reinforced concrete wrappers and the connections which secure together the several units at the same time form the centering or spacing means for the piles and coöperate in securing the units to the piles. The deck sections of the dock may be integral with or separate from the girder or beam sections and in either case are preferably provided with embedded diagonal spacing and bracing rods projecting beyond the corners of the units and provided with loops or other analogous means for facilitating the connection of the several units to each other and at the same time to the piling. These projecting loops of the diagonal spacing and bracing rods are adapted to be placed in registry with each other, a bonding space being provided between the several units and in this bonding space the connections are made.

My invention will be clearly understood with reference to the accompanying drawings, which as above stated, illustrate merely the principles involved in the invention.

Figure 1 is an isometric view of the upper portion of a dock constructed in accordance with my invention, some of the units being omitted and parts being broken away to show some of the details referred to. Fig. 2 is a longitudinal sectional elevation through the girder portion of one of the units illustrating the arrangement of the units upon the piles and certain connections. Fig. 3 is a detail cross sectional elevation through the girder portion of one of the units showing the reinforcement and arrangement of the dependent unit upon the supporting unit hereinafter referred to. Fig. 4, is a similar view showing the modification in the connection of the dependent and supporting units. Fig. 5 is a plan view of the connections made between the reinforcements of adjacent units. Fig. 6 is an underneath isometric view of a dock constructed under the same general principles as shown in the previous views but embodied in a different form of construction. Fig. 7 is an isometric view of the upper portion of a dock embodying the principles already shown and illustrating still another form of construction to which the invention may be applied. Fig. 8 is an elevation part in section, of portions of the dock shown in Fig. 7. Fig. 9 is a detail plan view showing the arrangement of the girder and bracing units on a pile. Fig. 10 is a cross section through the bracing portion of the girder units

shown in Fig. 8. Fig. 11 is a detail elevation showing a modification of the girder units and braces shown in Fig. 8.

Referring now more particularly to the drawings, 20 indicates a system of piling, the several elements of which are accurately spaced in driving and are preferably formed of wooden cores with reinforced concrete wrappers such as set forth in my earlier applications filed June 2, 1908, Serial No. 436,271 and July 29, 1908, Serial No. 445,951. In these applications I have described the wrapping of a wooden core with a plurality of layers of metal fabric and concrete continuously wound upon the core, but it is of course obvious that other forms of piling might be found more suitable in particular instances as for example, reinforced concrete piling, especially if the bonding space be left in the upper portions of the piles to facilitate the connections hereinafter described. In the form of my invention illustrated in Fig. 1 some of the reinforced concrete units comprise girder and deck sections integral with each other while others are formed only as deck sections and are intended to be supported by the girder portions of the units which have the deck and girder portions integral with each other. The supporting units comprise the deck portions 21 and the girder portions 22. The girder portions 22 extend around all four sides of the supporting units and project a suitable distance beyond the deck portions to form supporting ledges upon which the dependent units comprising only the deck portion 23 may be placed. The supporting units rest upon the piling, each supporting unit preferably being dimensioned so that each of its corners which are recessed as at 24 will rest upon one pile. As shown in Fig. 1, the units are arranged so that a space for a dependent unit is left between the four inclosed sides of the supporting units. The dependent units do not entirely fill this space but a bonding space 25 is left between the dependent and supporting units. This bonding space communicates with the bonding space left by the recesses 24 at the corners of the supporting units and this latter bonding space communicates with a bonding space 26 which is provided in the upper portion of the pile.

The outside units of the dock may be formed in any suitable manner to provide the desired finish. Where the supporting units come at the edge of the dock the space above the supporting ledge of its girder portion which is not to be occupied by a dependent unit, may be suitably filled in, flush with the deck and the edge of the girder portion, and where a supporting unit would come at the edge of the dock this is preferably formed with a deck portion 27 resting on the girder portion 22 of the adjacent supporting unit and an integral girder portion 28 as clearly illustrated.

The deck portion of each supporting unit has embedded in it diagonal spacing and bracing rods 29 which have looped ends projecting beyond the concrete at the corners and registering with the looped ends of the diagonal spacing and bracing rods of the adjacent supporting unit. Through the registering looped ends of these diagonal spacing and bracing rods 29, a pin 30 of suitable form is passed. Pin 30 preferably extends down into the interior portion of the pile and may be suitably anchored therein, thus effectually connecting together the several supporting units and at the same time connecting them to the piling. Reinforcing bars of any suitable form may be employed to strengthen the girder portions of the supporting units as for example the upper and lower pairs of reinforcing bars 31 and 32 respectively. These reinforcing bars may be suitably connected together into a framework as by diagonal links 33 and 34 and transverse links 35 and 36, shown clearly in Figs. 2 and 3, and it is preferable that the lower reinforcing bars 32 extend beyond the end of the concrete across the center of the piling and be turned down into the pile to more securely connect the unit with the pile when the bonding material is applied. Overlapping portions of the lower reinforcing bars may be clamped together by suitable clamps 37 as clearly shown in Fig. 5. The upper reinforcing bars 31 extend a short distance beyond the concrete and are bent down and suitably connected with the lower reinforcing bars within the bonding space and are connected to the corresponding reinforcing bars of the opposite unit by the links 38 as clearly shown in Figs. 2 and 5.

The deck portions of the supporting and independent units are preferably provided with reinforcing metal fabric 39 preferably in the lower part of the deck portion (shown higher in Figs. 2 and 3 to avoid obscuring the connections of the reinforcing rods). This reinforcing metal fabric 39 preferably extends across the bonding space so that the overlapping portions of metal fabric from adjacent units may further aid in connecting together the several units when the bond is applied. The dependent unit may be provided with reinforcing bars 40 instead of the metal fabric 39, as shown in Fig. 4, the bars 40 being looped at their ends and projecting into the bonding space so that a modified form of link 41 connecting together the upper and lower reinforcing rods of the girder portion of the supporting unit may have

its end continued through the loop and bent over into the position indicated in dotted lines in Fig. 4, thereby effectually securing together the two units.

Instead of having some of the units supported by others the units may all be supported directly by the piling. In Fig. 6 I have illustrated one form of dock in which this construction is employed. In this form the units comprise deck portions 43 and girder portions 44, the girder portions extending around the sides of each unit and the units being dimensioned so as to occupy the space between four piles with their corners resting upon the piles. The two adjacent girder portions of abutting units together form a single girder in the finished dock and they are formed with horizontal flanges 45 which are clearly shown in the drawings so that a bond space is left between adjacent units. The corners of the units are the same as shown in connection with those already shown and described so that the bonding spaces within the upper portion of the piling, at the corners of the units and between the units all communicate. The deck portions are provided with the diagonal spacing and bracing rods 46 which are similar to those above described and connected in the same way to each other and to the piling. Any suitable reinforcements may be employed within either the deck or the girder portion or both as illustrated for example by the upper and lower reinforcing bars 47 and 48. The reinforcing bars of the several units may overlap and be connected together and to the piling as described so that when the bonding material is tamped into the bonding space the units are all rigidly secured together and to the piling and the connections are all inclosed within the bonding material. The sides of the units which form the edge of the dock may be finished off in any proper manner as having the outside units formed with a finished edge as shown at 49, or the finished edge 49 may be formed upon the regular units after they have been set in place.

In many instances it may be desired to brace the piling by special bracing members. In the embodiment of my invention shown in Figs. 7, 8, 9 and 10 I have provided for this by employing special girder units which comprise the braces for the piling and which are separate from the deck portion of the dock. The girder portion of these units is illustrated at 50 and the braces at 51. Upright portions 52 extend between the outside ends of the girder and bracing portions and rest upon the piling as clearly shown in Figs. 7, 8 and 9. The bracing and girder portions of these units may have any desired form of reinforcement. For example the reinforcement of the girder portion may comprise the upper and lower pairs of reinforcing rods 53 and 54 respectively connected together by any desired form of links such as 55, while the reinforcement of the bracing portion 51 may comprise the upper and lower pairs of reinforcing bars 56 and 57 respectively, connected to the girder portion and one extended across the bonding space and the top of the piling, the other bent downward within the bonding space to more effectually secure the unit to the piling. A looped rod 58 preferably connected with one of the upper reinforcing rods 53 of the girder portion 50 passes through the bracing portion 51 and projects into the bonding space over the center of the pile as clearly shown in Figs. 7, 8 and 9 to receive the centering pin hereinafter described.

The deck units in this form of my invention rest upon the girder and bracing units instead of directly upon the piling. The deck units comprise the deck portions 59 and when desired may also have girder portions 60 integral therewith extending crosswise of the girder portion 50, the latter being notched as shown in Fig. 7, to receive them. It is not necessary that the deck unit be equal in dimensions to the space within four piles but as shown these deck units may be subdivided into two or more sections, a lip 61 being formed on one edge of one or the other sections supporting the bonding material. The deck units are provided with diagonal spacing and bracing rods 62 having looped ends projecting beyond the corners in the manner already described so that a centering pin 63 or analogous member may pass through the registering looped ends of adjacent units or sections and also through the looped end of the bar 58 in the bracing portion 51 and down into the piling when the connection is made over the piling. In the intermediate connections between the several sections of the deck units the securing or centering pin 64 may be employed to pass through the registering looped ends of the diagonal rods which pin may be formed with the section or set into it during construction.

In place of the braces 51 shown in Figs. 7 and 8 it will in many instances be sufficient or preferable to enlarge the girder portion at the ends adjacent to the piling as illustrated in Fig. 11. In this figure I have shown a girder portion 65 with an enlargement 66 underneath the end and terminating in a downward projection 67 shaped preferably to conform with the curvature of the upper portion 68 of the pile so that the girder is set into the top of the pile. Reinforcing rods 69 may be employed passing longitudinally of the girder

portion 65 and projecting across the bonding space between the ends of adjacent girders. Vertical bars 70 may also be employed passing preferably into the bonding space within the top of the piling so as to strengthen the connection of the girder with the piling. The deck units 71 of any desired form are provided with diagonal spacing and bracing rods 72 similar to those already described and having their registering looped ends disposed above the center of the piling so that a single pin 73 may pass through them and connect the deck units to each other and to the piling.

What I claim is:—

1. A structure of the character described, comprising in combination a system of piling, a plurality of reinforced concrete units having diagonal rods embedded therein, with looped ends projecting beyond the concrete, the looped ends of adjacent units being adapted to be brought into registry with each other, and a pin passing through the registering looped ends of said diagonal rods connecting them to each other and to the piling.

2. A structure of the character described, comprising in combination a system of piling accurately spaced, reinforced concrete units having diagonal rods with looped ends projecting beyond the concrete, with the looped ends of adjacent units adapted to register with each other, a pin passing through the registering looped ends of the diagonal rods and connecting them to each other and to the piling, and bonding material inclosing such looped ends and the connection thus formed.

3. A structure of the character described, comprising in combination a plurality of piles having wooden cores with reinforced concrete wrappers extending above the wooden cores, reinforced concrete units having diagonal rods, means for connecting the diagonal rods to each other and to the piles, and bonding material inclosing the connection thus formed and filling in the wrappers above the cores.

4. A structure of the character described, comprising in combination a plurality of piles having wooden cores with reinforced concrete wrappers extending above the wooden cores, reinforced concrete units having diagonal rods embedded therein, means for connecting the reinforcements of the several units to each other, means for connecting the diagonal rods to each other and to the piles, and bonding material inclosing the connections thus formed and filling in the wrappers above the cores.

5. A structure of the character described, comprising in combination a plurality of piles having wooden cores with reinforced concrete wrappers extending above the cores, reinforced concrete units having diagonal rods embedded therein with looped ends projecting beyond the concrete, the projecting looped ends of adjacent units being adapted to register with each other, means for connecting the reinforcements of the several units to each other and a pin passing through the registering looped ends of the diagonal spacing and bracing rods and thereby connecting the diagonal rods to each other and to the piles.

6. A structure of the character described, comprising in combination a plurality of piles having wooden cores with reinforced concrete wrappers extending above the cores, reinforced concrete units having diagonal rods embedded therein with looped ends projecting beyond the concrete, the looped ends of adjacent units being adapted to register with each other, means for connecting together the reinforcements of the several units, a pin passing through the registering looped ends of the diagonal rods and thereby connecting them to each other and to the pile, and bonding material inclosing the connections thus formed and filling in the wrappers above the cores.

7. A structure of the character described, comprising in combination a plurality of piles having wooden cores with reinforced concrete wrappers extending above the core, a plurality of supporting units of reinforced concrete resting upon the wrappers of said piles, and each having a deck portion with supporting ledges integral therewith, dependent deck units adapted to rest upon said supporting ledges with spaces between adjacent edges communicating with spaces within the wrappers above the cores of said piles, means for securing the supporting units to the piles and bonding material filling in the spaces between adjacent units and within the wrappers of the piles above the cores.

8. A structure of the character described comprising in combination a plurality of piles having wooden cores with reinforced concrete wrappers projecting above the cores, a floor structure of reinforced concrete supported by said piles, a system of diagonal spacing and bracing rods embedded in the floor structure and secured together and anchored to the wooden cores of the piles at the points of intersection of the said rods and a filling of concrete within the projecting portion of the wrappers above the wooden cores.

9. A structure of the character described, comprising in combination a plurality of piles having wooden cores with reinforced concrete wrappers extending above the cores, a girder and floor construction of reinforced concrete supported on said piles, a system of diagonal spacing and bracing rods embedded in the floor structure and secured together and anchored to the wooden cores of said

piles at the points of intersection of said rods and a filling of concrete within the projecting portion of the wrappers above the wooden cores.

10. A structure of the character described, comprising in combination a plurality of piles having lower portions of wood incased in reinforced concrete with upper portions entirely of reinforced concrete, and a floor system of reinforced concrete resting upon and bonded to the piles.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."