

Aug. 30, 1927.

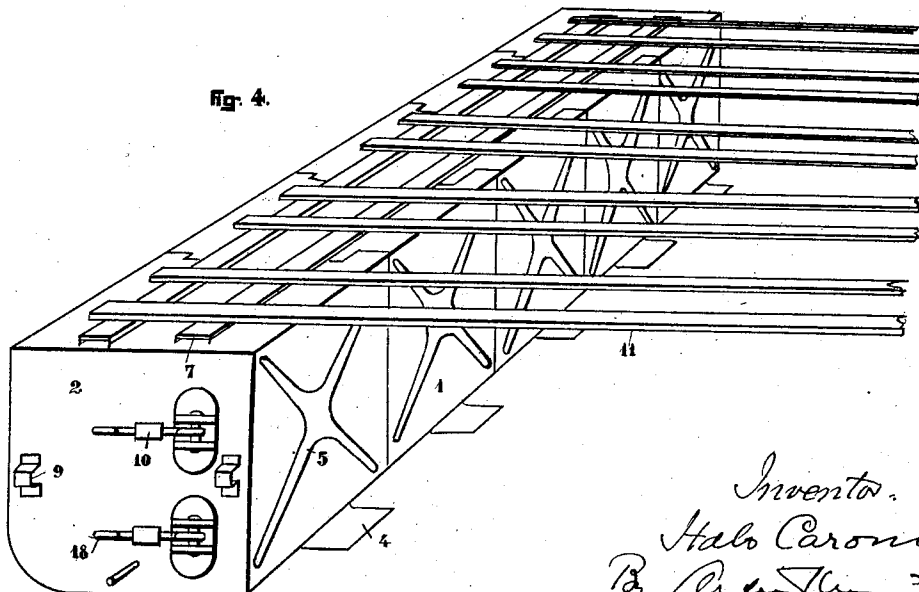
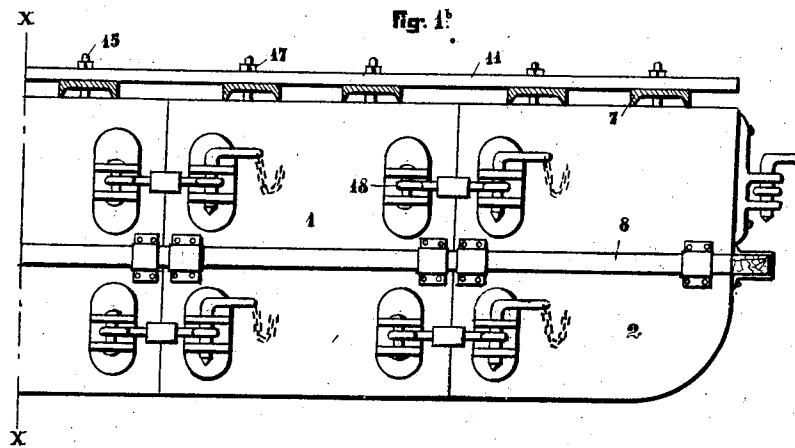
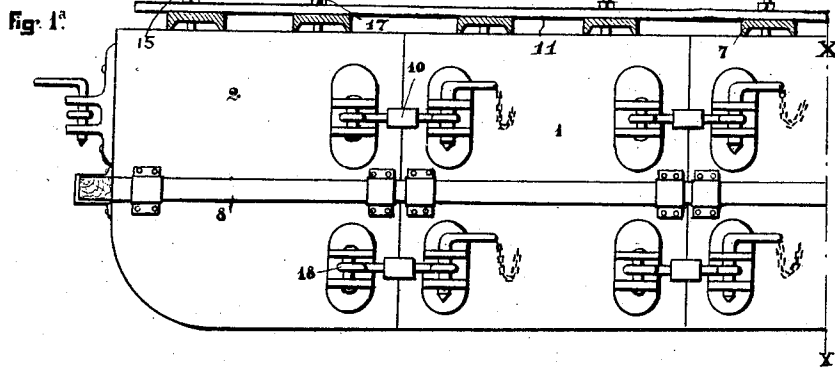
1,640,980

I. CARONI

BRIDGE MATERIAL

Filed Aug. 3, 1925

4 Sheets-Sheet 1



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Aug. 30, 1927.

1,640,980

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BRIDGE MATERIAL

Filed Aug. 3, 1925

4 Sheets-Sheet 2

Fig. 2.

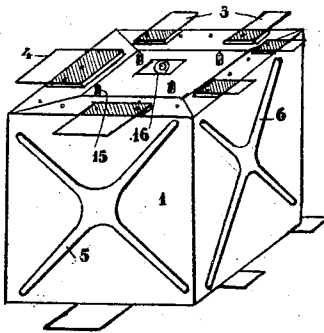


Fig. 3.

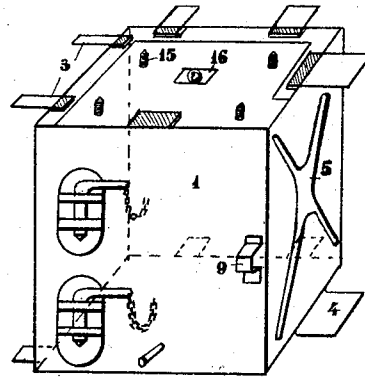


Fig. 6.

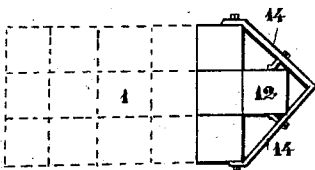


Fig. 7.

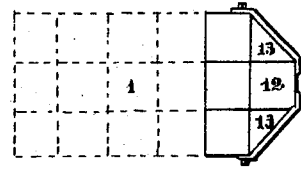


Fig. 5.

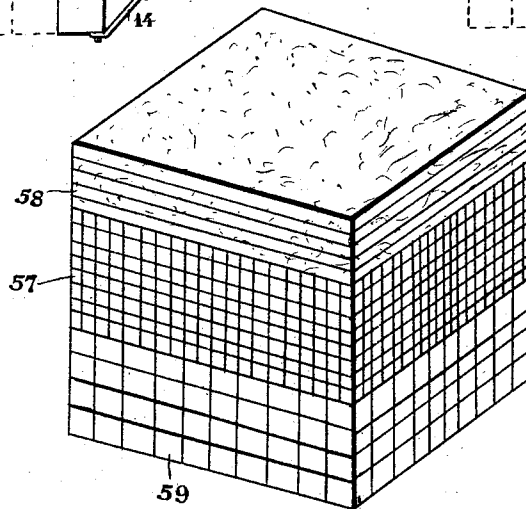
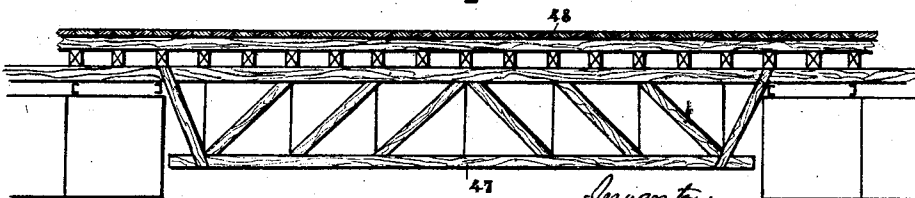


Fig. 8.



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Fig. 9.

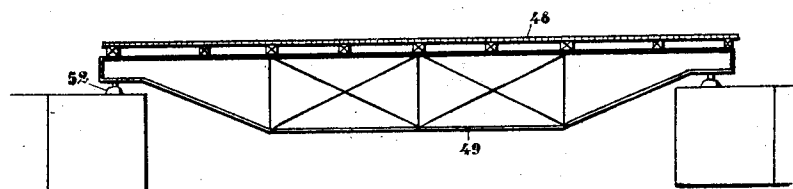


Fig. 10.

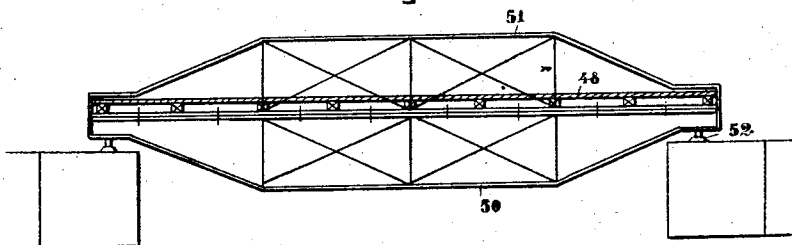


Fig. 11.

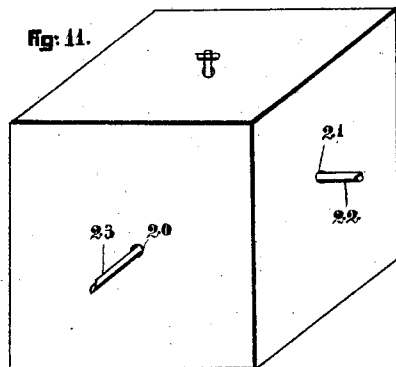
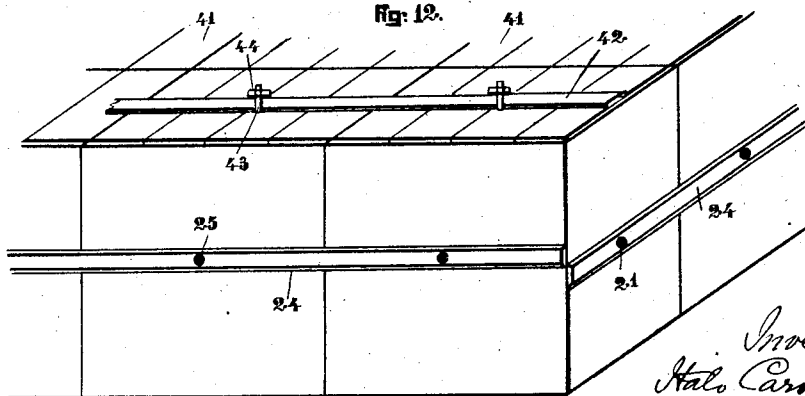


Fig. 12.



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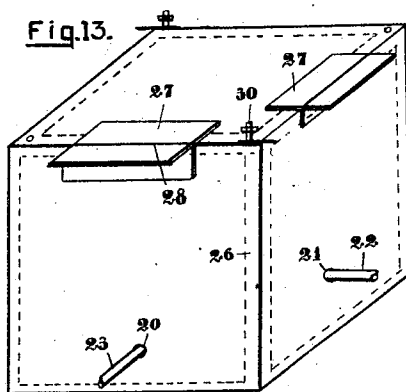
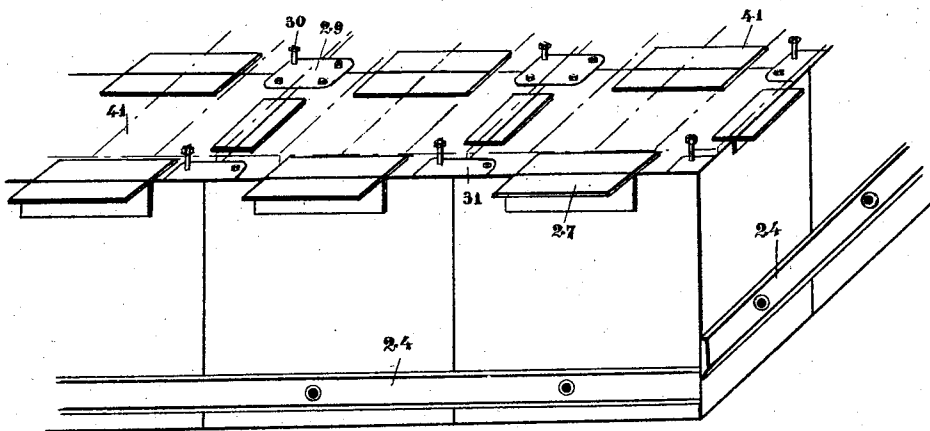


Fig. 14.



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UNITED STATES PATENT OFFICE.

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BRIDGE MATERIAL.

Application filed August 3, 1925, Serial No. 47,919, and in Italy August 6, 1924.

My invention relates to bridges and similar structures and has for its object to produce a new bridge material, especially for bridges for military use, permitting such bridges to be easily taken apart and transported. According to my invention, I provide floating units which may be connected together in various ways, either for the purpose of forming movable floating bodies of larger size, or so as to form permanent supports for the bridge flooring.

The improved bridge material according to this invention is formed of floating units consisting of a completely closed and watertight hollow metallic body of prismatic shape, each of said units being provided with means for the connection with adjacent units both in longitudinal and in transverse direction without intervening spaces, the invention being characterized by the arrangement and shape of the said connecting means.

Another feature of my invention consists in this that the floating units can be made unsinkable by means of special cellular structures placed inside said units.

In the annexed drawing schematically illustrating the invention,

Figs. 1^a and 1^b when placed side by side at the line $x-x$ are a side view of a floating body formed of five units, Fig. 2 is a perspective view of an intermediate unit, Fig. 3 a perspective view of an outside unit, Fig. 4 a perspective view of the connections between the several parts of a bridge under construction, Fig. 5 a perspective view of a type of structure used to make the hollow units unsinkable, Figs. 6 and 7 are top views schematically showing the arrangement of the piers and a number of units connected with each other, Figs. 8, 9, 10 show several forms of connections for the piers; Figs. 11 to 14 show another kind of connection of the floating units.

As will be seen from the drawing, the bridge is made up of a certain number of hollow floating units 1, suitably connected with each other. The number of said floating units both longitudinally and transversely (Figs. 1 and 4) can of course be changed to suit the existing conditions.

Each unit consists of a metal sheet body of prismatic shape. Its walls are either soldered or riveted so as to produce a staunch structure.

The end units 2 forming the stern and

the bow of the floating structure preferably are rounded so as to improve their navigation qualities and to lessen the resistance of the stream when the floating structure is anchored.

The several units are connected together in any suitable manner to form floating structures of any desired size and shape.

In the embodiment shown in Figs. 1 to 4, each unit has along its upper and lower surface two continuous walls provided with two lateral projections 3 and two sides provided with a central lateral projection 4 adapted to enter the space between the two projections 3 of an adjacent unit. The projections are all made like steps.

The side walls provided with the projections 3 have ribs 6 while the walls provided with the projections 4 have corresponding grooves 5, which arrangement permits the units to be quickly and surely connected together as shown in Fig. 4.

In order to ensure a fair distribution of the load upon the units of each floating structure, the units carry a flooring made of metal beams 7 of suitable cross-section, e. g. channel shaped, which beams extend over the upper surface of each unit being fastened thereto by means of screw bolts 15.

After the floating units have been connected, the whole structure is enclosed between four hard timber beams 8, extending through iron straps 9 carried by the outside units.

Each outside unit is provided with a certain number of adjustable bolts 18 which can be lengthened or shortened at will, by means of a sleeve 10 having two threads of opposite pitch.

Figs. 11 to 14 show another kind of connection between the units, by means of central rods, outside beams and the eventual addition of clamping projections and joining plates.

In Fig. 11 is shown in front view an isolated floating unit while Fig. 12 shows a number of outside units connected, each one of them being traversed by two tubes 20 and 21 extending at right angles to each other and placed at a suitable distance one from the other. The tube 20 connects the front wall of the unit with the back wall and is soldered at its end to said walls. Tube 21 connects in a similar manner, the lateral walls of the unit.

Within said tubes are provided two rods

22 and 23 which serve for the connection of a certain number of adjoining units. The outer ends of said rods project on the outside of the structure formed by said units, and by means of an outer screw nut two U-shaped irons 24 are secured, which form a peripheral belt of the structure about the middle of the structure's height.

In order to uniformly distribute the weight on the floating structure, there is provided on its upper surface a planking 41 retained in place by transverse irons 42 having holes through which pass pins 43, projecting from the upper surface of each unit and onto which pins the locking nuts 44 are screwed.

According to Figs. 13 and 14, the edges of each unit are reinforced by frames 26 of angle irons to which are attached the plates forming the walls of the unit, while on the upper and lower faces are fixed some T-shaped irons 27. The projecting web 28 of said irons acts as a connecting member with the adjoining unit.

The upper and lower surfaces of each group of four units reinforced in the aforesaid manner, are connected together by means of plates 29, secured to a planking 41 and supplied each with four holes to receive one of the four connecting pins 30 fixed on the stiffening frames near their vertices. The plates 31 for connecting the terminal units have, instead of two holes, one hole only.

Near their bases, the units are connected together by means of tubes 20—21, rods 23 and U-shaped irons 24 similarly to what has already been described with reference to Figs. 11 and 12. Some pins 30 are longer than others and serve for their connection with the irons intended to hold the planking of the bridge and of the raft.

A floating structure built from the single units being connected together in any of the aforesaid manners, may be used as a life-saving raft or landing-raft, or barge, or lighter for the conveyance of materials or passengers upon the water for which purpose it may be supplied with cars or a motor suitably fitted on the outside.

The structure may also be used as a supporting pier for a bridge planking intended for the crossing of a stream. In that case, it will be supplied with anchors or cables to moor it, and, instead of a rectangular shape, the structure is given a pointed shape fore and aft so as to lessen the resistance of the water.

The pointed shape given to the pillar, and which is necessary when the current is strong, can be obtained, as shown in Fig. 6, by one unit 12 and two half units 13 being cut along a diagonal line, or, as shown in Fig. 7, by means of a unit 12 having two guard plates 14 for cutting the water.

As soon as such structures have been anchored or moored, it is necessary to look after their connection with the planking, for which purpose, in case the structure has been made according to Figs. 1 to 4, there is placed on the frame formed by the beams 7 another wooden frame formed by beams 11.

The beams 11 are connected with the beams 7 by means of the same connecting pins 15, onto whose threaded ends are screwed the nuts 17.

Other connecting forms of the piers or floating structures are shown in Figs. 8, 9 and 10 wherein may be seen that the piers can be joined together by means of wooden girders 47 (Fig. 8) upon which is afterwards placed the planking 48, or by means of iron girders 49 (Fig. 9), or by means of two girders 50 and 51 (Fig. 10) placed one upon the other. Through the latter arrangement especially the central part of the bridge which may be reserved for the passage of very heavy loads is reinforced.

The connecting girders, whatever their shape, instead of resting directly on the pillars are supported by interposed contrivances 52 fitted to allow the movement of the bridge in a horizontal, vertical or circular direction.

As has already been stated, one of the chief features of the invention consists in this, that the single units 1 can be rendered unsinkable by filling the inside space of the units with blocks of a light material, such as cork, for instance, india-rubber froath or even a cellular structure of a very thin metal plate.

In practice, where such bridges are exposed to the enemy's fire, it will be better to fill the units 1 with blocks of a mixed structure, formed, as shown in Fig. 5, by large cells 59 to fill the lower and submerged part of the unit, with smaller cells 57 in the intermediate part and by layers of cork 58 in the upper part which, always remaining above the water surface, is most exposed to shots.

In some cases it may be necessary to have such supporting structures submerged or resting on the bottom of a stream. For this purpose, a certain number of units without cellular cork but with a hole in the upper part are made, which hole can be closed by a screw cover 16 (Figs. 2 and 3), or in any other way. Through the holes, the unit can be filled with sand or gravel in order to sink them in the spot where they are to remain permanently to be used as supports. It is obvious that when the bridge later is broken up, these elements can be emptied and therefore recovered.

It will be seen that with the above described units, suitably grouped either side-wise or lengthwise, floating bodies of any

size whatsoever can be constructed, capable of supporting heavy artillery guns, armoured tanks or any other heavy weights which could not be borne by the pontoons of an ordinary pontoon-bridge.

The sizes of the units are selected in such a way, for instance 1 cubic meter, so that each one of them may be easily transported, for which purpose the upper face is supplied with a suspension ring 16 to hang it up, while for carrying them over a long distance they can be placed on lorries occupying little space.

It is to be understood that the prismatic shape of the units and the means of connecting them have been described only by way of example, and that both the shape of the units and the means of connecting them may vary while remaining within the scope of the invention.

Thus, for instance, the units may be made collapsible by means of folding walls so as to occupy the least place possible and offering the least resistance to the air, which is particularly important when the units must be carried on mules' backs, or by airplanes.

The inside of the collapsible units may be occupied by an india-rubber air-chamber, or by permanent layers made of light material.

I claim:

1. In a floating structure, the combination with a plurality of floating units each comprising a completely closed, water tight hollow metal body of rectangular prismatic shape, of means connecting adjacent units both in longitudinal and transverse directions, to form a compact structure, and means comprising a rigid girth surrounding the floating structure to better keep the assembled units together and to secure greater stiffness.

2. A floating structure as specified in claim 1, in which the means for connecting the adjacent units both in longitudinal and transverse directions consists of spaced projections provided along the upper and lower surface of each unit and mutually engaging grooves and ribs provided on the lateral walls of said units.

3. The combination as specified in claim 1, comprising blocks of cellular construction in their lower portion, their upper portion being formed of layers of cork or similar material, said blocks filling the inner space of said hollow units.

In testimony whereof I affix my signature this 15th day of July, 1925.

ITALO CARONI.