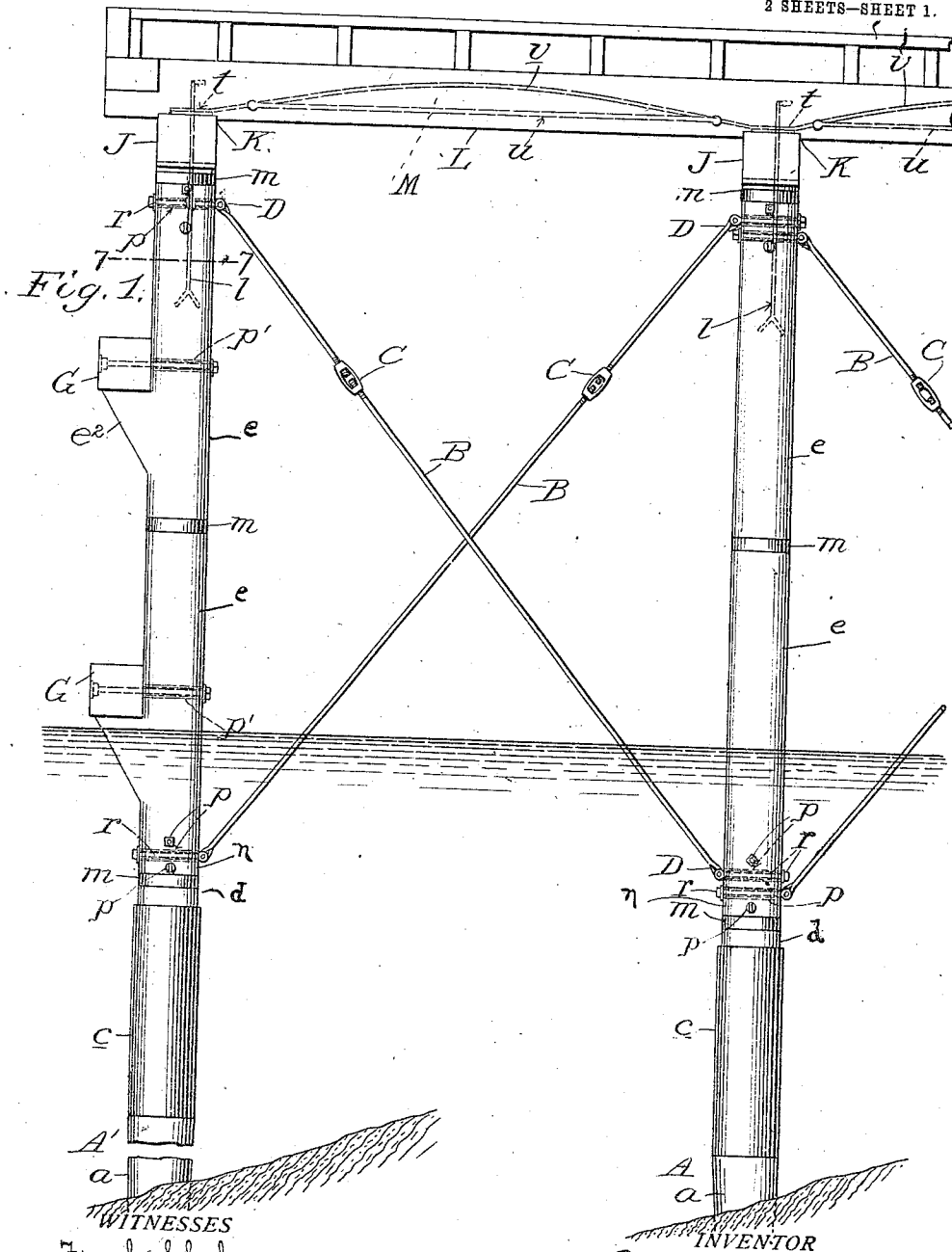


963,061.

Patented July 5, 1910.

2 SHEETS—SHEET 1.



WITNESSES
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 PILE AND PILE STRUCTURE.
 APPLICATION FILED JULY 8, 1909.

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2 SHEETS—SHEET 2.

Fig. 2.

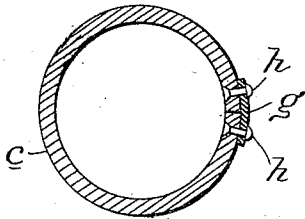


Fig. 3.

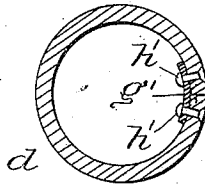


Fig. 4.

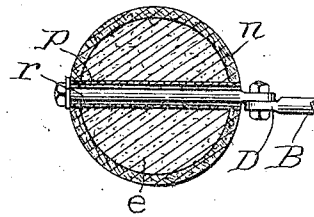


Fig. 5.

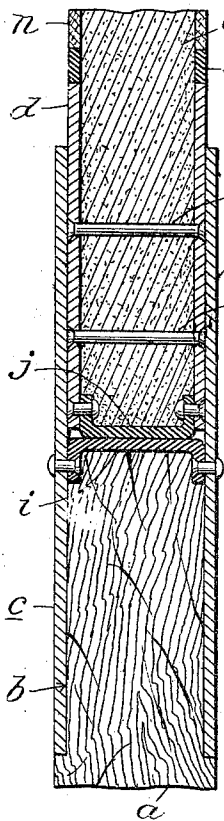


Fig. 6.

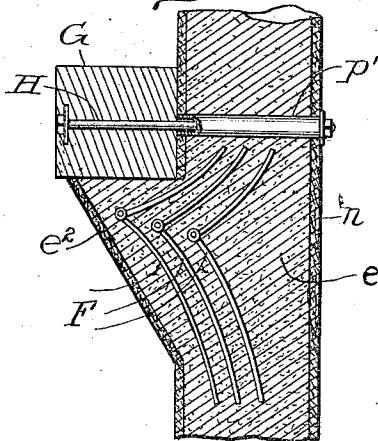


Fig. 7.

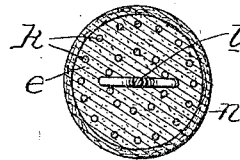
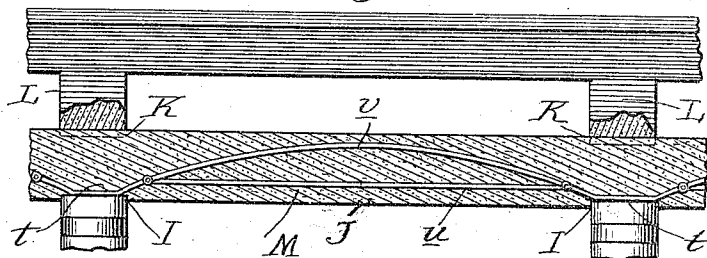


Fig. 8.



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PILE AND PILE STRUCTURE.

963,061

Specification of Letters Patent.

Patented July 5, 1910.

Application filed July 8, 1909. Serial No. 506,541.

To all whom it may concern:

Be it known that I, FRANK ANTHONY NOULLET, citizen of the United States, residing at New Orleans, in the parish of Orleans and State of Louisiana, have invented new and useful Improvements in Piles and Pile Structures, of which the following is a specification.

My invention pertains to hydraulic engineering and more particularly to piles and superstructures supported thereby; and it has for one of its objects to provide a strong pile constructed with a view of being readily fixed in position in a secure manner, and of withstanding without material deterioration the conditions to which piles are ordinarily subjected.

Another object of the invention is the provision of piles constructed with a view of being combined and connected together and braced in order to constitute a stable support for anything that may be placed thereon.

Another object is the provision in combination with a plurality of piles, of girders constructed of reinforced concrete and connected with the piles in such manner that the girders are possessed of great strength in proportion to their size.

Another object is the provision of piles provided with appurtenances whereby they are adapted when arranged at the end of a wharf or dock to withstand the impact of a landing ship, and prevent the same from injuring the wharf.

Other objects and advantageous characteristics of the invention will be fully understood from the following description and claims when the same are read in connection with the drawings, accompanying and forming part of this specification, in which:

Figure 1 is a broken elevation of so much of a structure as is necessary to illustrate the best practical embodiment of my invention of which I am cognizant. Fig. 2 is a transverse section illustrating the manner in which I prefer to construct the metallic socket embodied in each of the piles. Fig. 3 is a similar view illustrative of the manner in which I prefer to construct the metallic shoe comprised in each pile and adapted to receive and reinforce concrete or other plastic material and lend increased strength to the connection between the same and the socket. Fig. 4 is a transverse section illustrative of the manner in which the

metallic stays are connected with the piles. Fig. 5 is a detail diametrical section showing the construction of the intermediate portion of the pile. Fig. 6 is a detail vertical section showing the means on the outer pile for supporting and holding a bumper of wood or other material suitable to its purpose. Fig. 7 is a transverse section taken in the plane indicated by the line 7-7 of Fig. 1 and showing the reinforcing means in the concrete together with the anchor for effecting connection between the concrete portion of the pile and a concrete girder superposed thereon. Fig. 8 is a detail section taken at a right angle to Fig. 1 and showing the manner in which the concrete girder arranged above each pile is reinforced between piles.

Similar letters designate corresponding parts in all of the views of the drawings, referring to which:

A and A' are piles of which any suitable number may be employed as occasion demands. Each of the said piles comprises a lower wood portion *a* designed to be driven downwardly through the bottom of a body of water or through other earth until it brings up against a hard stratum, and having its upper portion *b* reduced; a metallic socket *c* which is preferably driven on the reduced portion *b* of the wood before said reduced portion is below the low water line; a metallic shoe *d* positioned in the socket *c* and above the wood portion *a*, and concrete or other suitable plastic material *e* arranged within and extending above the said socket. The metallic socket *c* is preferably formed in the manner shown in Fig. 2—that is to say, by bending a sheet of metal into tubular form, and connecting the meeting edges of the said sheet through the medium of a coupler comprising a bar or plate *g* arranged at the outer side of the sheet, and rivets *h* headed at their outer ends and driven through the bar or plate *g* and the edge portions of the sheet and having their inner ends mashed and countersunk in the inner sides of said edge portions. Manifestly in this manner a strong and durable socket is produced and one possessed of the requisite stiffness and interior smoothness.

At an intermediate point of its length the socket *c* is provided with a metallic diaphragm *i* having its edge turned downwardly and riveted to the wall of the socket as best shown in Fig. 5; the said dia-

phragm *i* being adapted when the socket *c* is driven on the wood portion *a* to bear and rest upon the upper end of the said wood portion. The metallic shoe *d* is preferably constructed in a reverse manner to the socket *c*—i. e., of a sheet bent into tubular form and having its contiguous edges connected through the medium of a bar or plate *g'* extending lengthwise of the shoe and within the same, and rivets *h'* headed at their inner ends and extending through the bar or plate *g'* and, the edge portions of the sheet, and having their outer ends mashed and countersunk in the outer sides of said edge portions, whereby the shoe is rendered stiff and strong and at the same time smooth at its outer side to adapt it to be tightly fitted and held in the portion of the socket *c*, above the diaphragm *i* thereof.

The bottom of the shoe *d* is closed, preferably by a diaphragm *j* of metal connected to the shoe as shown and adapted to support the concrete in the shoe and to bear upon the diaphragm *i*, Fig. 5. The concrete *e* extends from the bottom or diaphragm *j* of the shoe *d* a suitable distance above the upper end of the shoe, and it will be observed by reference to the drawings that the said concrete is reinforced by vertical rods *k*, of metal, and that a metallic tie-bar *l* is securely anchored in the upper portion of the concrete and extends upwardly beyond the upper end thereof for a purpose herein after set forth. It will also be observed in the drawings that at intervals of its length the concrete *e* is provided with metallic collars *m* the exterior diameter of which corresponds to that of the shoe *d*; that a coating of cement plaster i. e., plastic cement *n* surrounds the concrete *e* between the lower collar *m* and the intermediate collar *m*, and also between said intermediate collar *m* and the upper collar *m*; and that metallic tubes *p* extend diametrically through the concrete and the cement plaster, and are designed for the reception of bolts *r*, each of which has an eye at one end and a nut or other securing device at its opposite end. The said collars *m* serve by surrounding the concrete *e* to reinforce the same and in that way lend increased strength to the pile. The reinforcing rods *k* and the tie-bar *l*, the metallic collars *m*, and the metallic tubes *p* as well as the shoe *d* which is connected to the concrete by diametrical bolts *s*, are all arranged as shown, relative to the concrete portion *e* at the time of the manufacture thereof, and after the concrete has hardened or set the covering of cement plaster is applied; the said covering *n* being exteriorly of a diameter corresponding to the exterior diameters of the shoe *d* and collars *m*, so that the exterior diameter of the reinforced concrete portion of the pile is

uniform throughout the length of the said reinforced concrete portion. I would also here state that by preference all of the metallic elements entering into my novel pile are preferably provided with two coats of Galvanum paint or its equivalent before being placed in position. I would also state that the cement plaster covering *n* is adapted to render the exterior of the reinforced concrete portion of the pile smooth, and by covering all of the indentations left in the exterior of the concrete portion *e* at the time of manufacture thereof, is adapted to prevent water from lodging in or working against the said indentations, with the result that the period of usefulness of the said concrete portion *e* is materially prolonged.

It will be understood from the foregoing that the concrete portion *e* is equipped with the appurtenances mentioned at any suitable time or place, and that the said concrete portion *e* and its appurtenances, including the metallic shoe *d*, are handled as a unit and arranged as described, relative to the socket *c* after the said socket *c* has been driven on the wood portion *a*. At this point I deem it proper to say that after the metallic socket *c* is driven on the wood portion *a*, a wood follower (not shown) is arranged in the upper portion of the socket *c* and upon the diaphragm *i*; and the blows of the pile driver are imposed on the said follower until the wood portion *a* is carried to the point desired below the lowest water mark; it being desirable for the wood portion *a* to always be below the water in order to prolong the usefulness of the said wood portion. Then after the wood portion *a* and the steel socket *c*, which socket is also covered with Galvanum paint or its equivalent, are positioned as described, the concrete portion *e* equipped with the shoe *d* and the other appurtenances described, is arranged so that the shoe *d* is snugly received in the socket *c*, whereupon the said shoe *d* and socket *c* will cooperate to effect a strong and durable connection of the concrete portion *e* with the wood portion *a*. After being secured in position as described, the concrete portions *e* of the two piles A and A' are connected through the medium of crossed stays B, having turn-buckles C and also having hooks D designed to be engaged with the eyes at the ends of the bolts *r*, which extend through the metallic tubes *p*, as before described, the said crossed stays B being adapted to unite the piles in a single structure and contribute to the strength and weight-bearing capacity of the structure. The said stays B in common with the other metallic elements of the structure are preferably coated with Galvanum paint or other preservative precedent to being placed in position.

It will be observed by reference to Fig. 1

that the metallic sockets *c* and the metallic shoes *d*, as well as the wood portions *a* of the piles, are arranged entirely below the lowest water mark, since said arrangement conduces to prolonging the usefulness of the metallic sockets and shoes.

In addition to the elements enumerated, each pile *A'* comprises metallic tubes *p'* embedded in the concrete portion *e*, and arms *e'*, of concrete, integral with the portion *e*, and reinforced by metallic sections *F*, which are embedded in the concrete portion *e* and the concrete arms or brackets *e'*, as shown. The arms or brackets *e'* of the pile *A'* are designed to support bumpers *G*, of wood or other suitable material, which bumpers are connected to the pile by bolts *H* extending through the bumpers and the tubes *p'*. From this it follows that piles of the *A'* type are adapted more especially for use at the outer end of a wharf or dock, the bumpers *G* in such location being adapted to receive the impact of ships and protect the wharf against injury. I would have it understood, however, that the use of piles of the *A* type is not limited to wharves or docks, inasmuch as said piles of the *A* type may obviously be used to advantage in bridge work, trestle work and other work to which they are applicable.

In the embodiment illustrated, the upper ends of the concrete portions of the piles are let into recesses *I* in the under sides of girders *J*, and the said girders *J* in turn are let into recesses *K* in the under sides of girders *L* disposed at right angles to the girders *J*, and the tie-bars *l* of the piles are extended upwardly through the girders *J* and into the girders *L*, at which latter point the tie-bars are suitably secured, whereby it will be manifest that the tie-bars *l* will serve to strongly connect the girders together and to the piles. The girders are preferably formed of concrete or other plastic material, and each is provided with a metallic reinforcement *M* embedded therein, and made up of plates *t* disposed in vertical alinement with the piles and receiving the tie-bars *l*, and spans extending between the said plates *t* and respectively made up of lower straight bars *u* and upper curvilinear bars *v*. By virtue of the said spans it will be readily observed that the weight-bearing capacity of the portions of the girders between supports is materially increased. Upon the girders any desired structure may be superposed, but I have deemed it unnecessary to illustrate such structure, inasmuch as it forms no part of my invention.

As before stated, the construction herein illustrated and described constitutes the best practical embodiment of my invention of which I am aware, but it is obvious that in the future practice of the invention such

changes or modifications may be made as do not involve departure from the scope of my invention as defined in my appended claims.

Having described my invention, what I claim and desire to secure by Letters-Patent, is:

1. A pile comprising a lower portion, a metallic socket mounted on said portion and having a diaphragm at an intermediate point of its length bearing on the upper end thereof, an upper concrete portion, and a metallic shoe surrounding and secured on the lower end of the upper portion and having its lower end closed and disposed against the lower end of said upper portion; said shoe being disposed in the socket and on the diaphragm thereof and extending above the said socket.

2. In a pile, the combination of a lower portion; a metallic socket comprising a sheet of metal of tubular form and a bar arranged at the outer side of and connected to the edge portions of the sheet, said socket being mounted on said lower portion and having a diaphragm at an intermediate point of its height bearing on the upper end thereof; an upper concrete portion; and a metallic shoe comprising a sheet of metal of tubular form and a bar arranged at the inner side of and connected to the edge portions of the sheet, said shoe surrounding and being secured on the lower end of the upper portion and being disposed in the socket and on the diaphragm thereof and extending above the said socket.

3. A pile comprising a portion of plastic material such as concrete, metallic portions arranged on the concrete portion and separated by an intervening space, and a plastic coating surrounding the concrete portion and interposed between and arranged flush with the said metallic portions.

4. A pile comprising a lower wood portion, a metallic socket mounted on said portion and having a diaphragm at an intermediate point of its height bearing on the upper end thereof, an upper concrete portion, a metallic shoe arranged on and connected to the concrete portion and also arranged in the upper portion of the socket and having its lower end closed and disposed on the diaphragm of the socket, metallic portions surrounding the concrete portion above the metallic shoe, and a plastic coating surrounding the concrete portion and interposed between and arranged flush with the said metallic portions.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

FRANK ANTHONY NOULLET.

Witnesses:

W. E. HARTIG,
JOS. E. GALLÉ.