No. 685,447. Patented Oct. 29, 1901.

G. W. JACKSON.

METALLIC SHEET PILING.

(Application filed Nov. 1, 1900.)

(No Model.)

2 Sheets—Sheet 1.

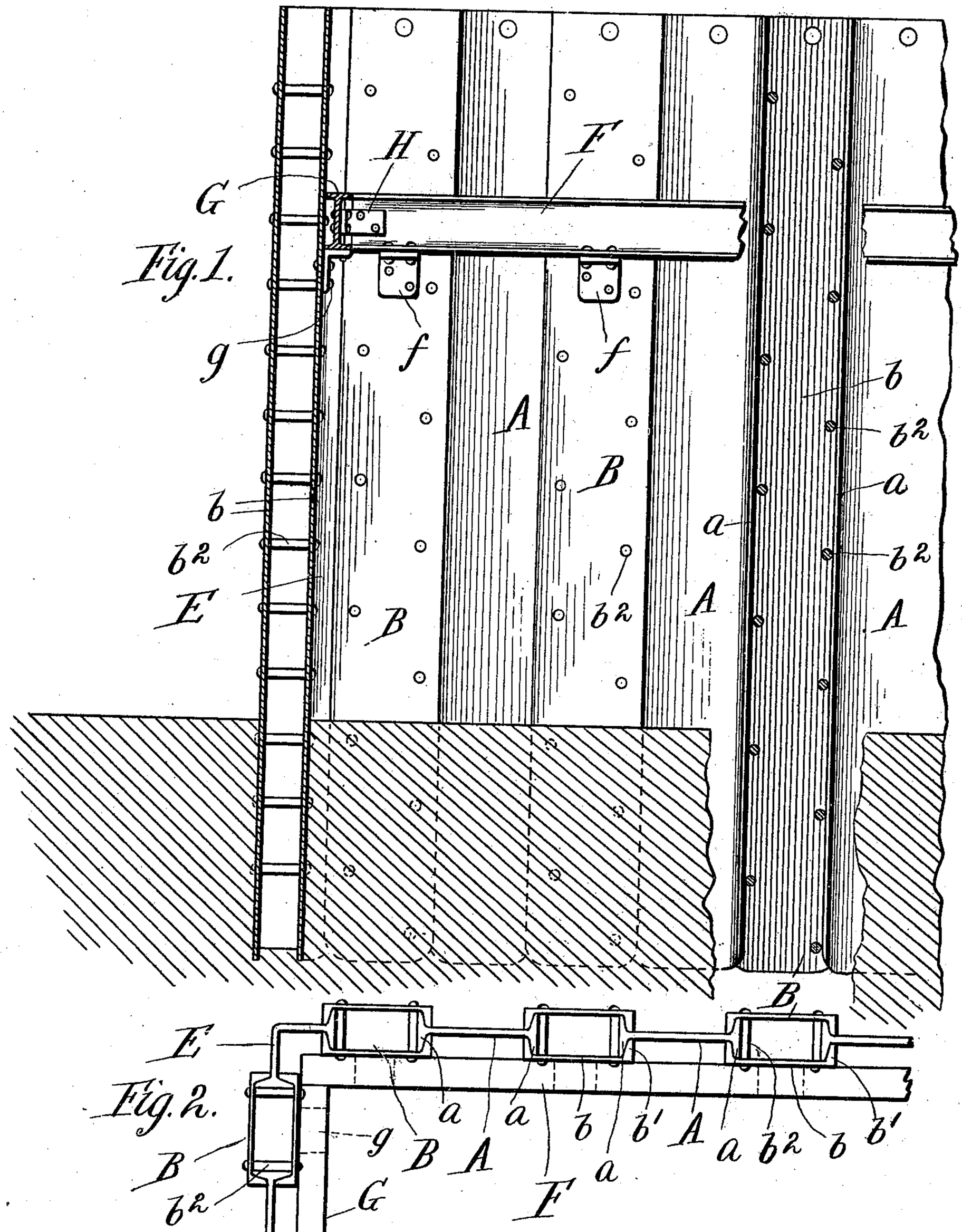

Fig. 1.

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

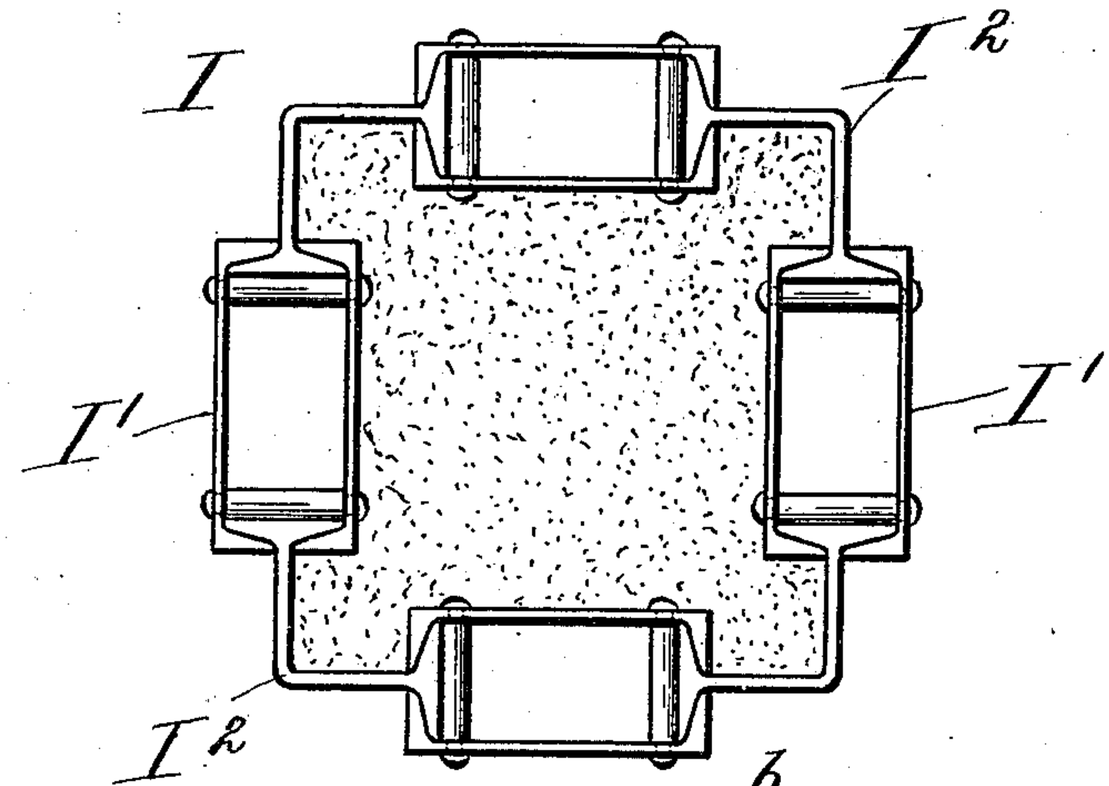


Fig. 4

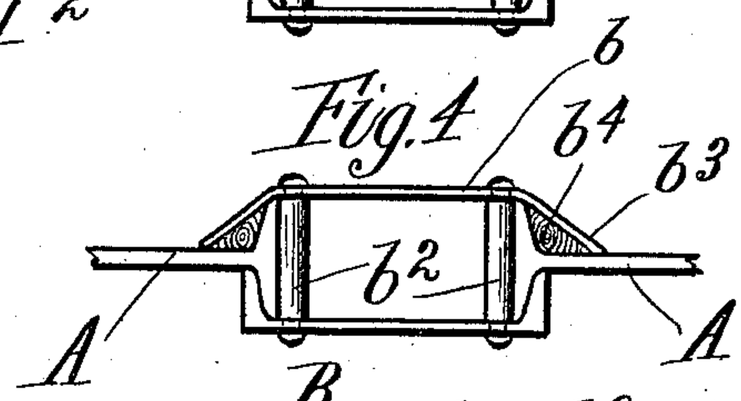


Fig. 5.

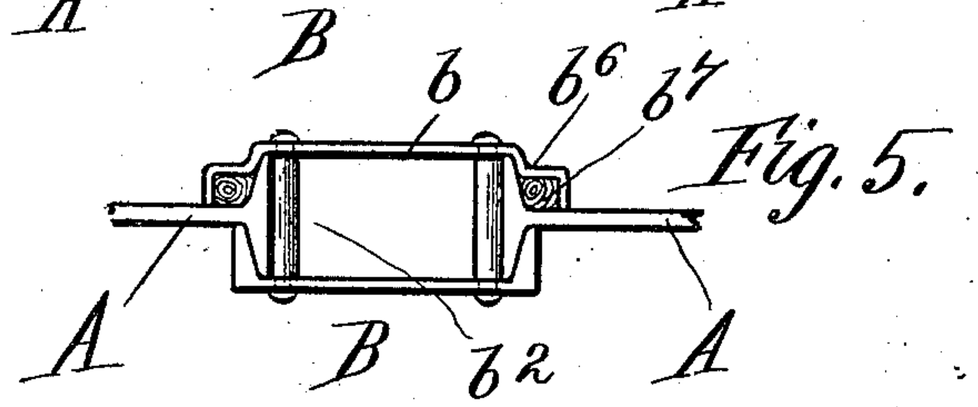
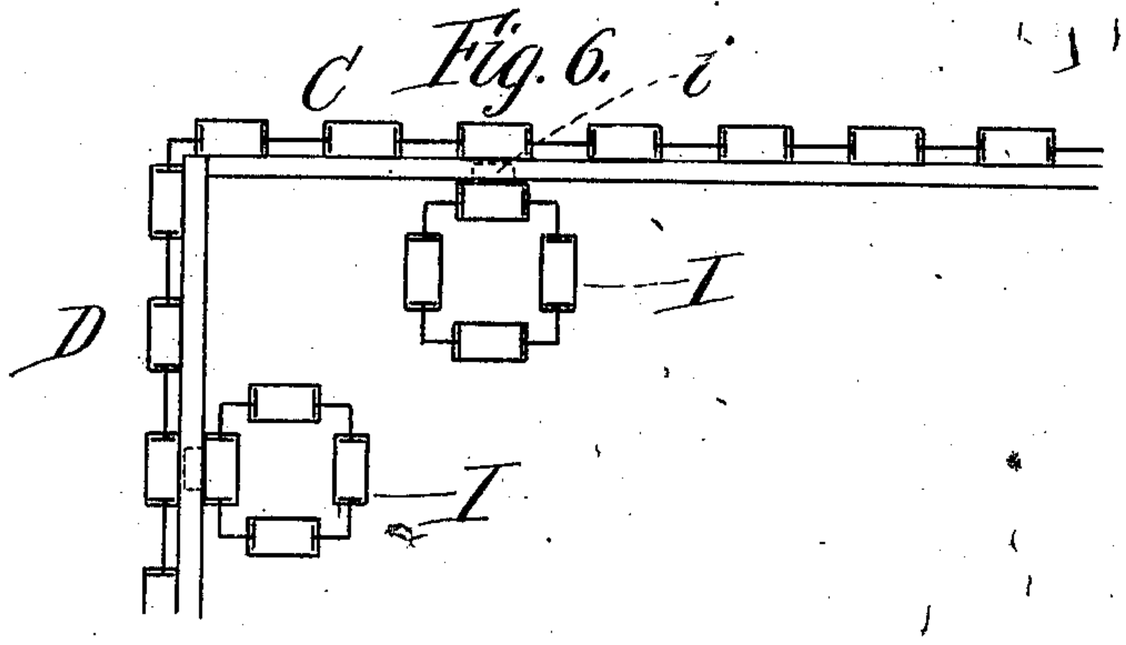


Fig. 6.



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UNITED STATES PATENT OFFICE.

GEORGE W. JACKSON, OF CHICAGO, ILLINOIS.

METALLIC SHEET-PILING.

SPECIFICATION forming part of Letters Patent No. 685,447, dated October 29, 1901.

Application filed November 1, 1900. Serial No. 35,073. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. JACKSON, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Metallic Sheet-Piling; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in pile constructions used for the protection of earth excavations, for the walls of coffer-dams, for the retaining-walls of wharves or piers, for the foundation-supports for buildings and like structures, and for other like purposes.

A pile structure made in accordance with my invention consists of a plurality of sheet or rolled metal piling sections or beams which are adapted to be driven into the ground edge to edge and have interlocking longitudinal connection at their adjacent edges by parts so shaped that the beams can be connected and disconnected only by endwise relative movement thereof, thereby constituting when the beams are driven a continuous structure the parts of which are locked from lateral movement with respect to each other. The piling sections or beams so made may be variously assembled to constitute as a completed structure such constructions as a hollow pile, a continuous wall or sheeting for retaining-walls of coffer-dams, for supporting-piers for bridge and like structures, and many other purposes, some of which are hereinafter pointed out and others of which will suggest themselves to persons skilled in this art.

In the drawings, Figure 1 is an inside view of the corner or angle between two walls of a coffer-dam structure, the said walls and supports therefore being constructed of piling sections or beams made in accordance with my invention. Fig. 2 is a plan view thereof. Fig. 3 is a plan view of a hollow pile made in accordance with my invention. Figs. 4 and 5 show connections between the pile-sections designed to produce waterproof joints. Fig. 6 is a plan view of a modified form of coffer-dam construction.

As before stated, a sheet-piling made in accordance with my invention consists of a plurality of metal beams which are so shaped on their side edges as to afford interlocking connections between adjacent beams constructed to prevent lateral separation of the assembled sections or beams. Said interlocking connections are so made as to permit relative longitudinal movement of adjacent beams, whereby when one beam is driven to place in the ground it serves as a guide for the beams next adjacent thereto, and so on until the structure is completed.

I have shown in Figs. 1 and 2 of the drawings one form of sheet-metal piling, and in such figures said piling is embodied in a fragmentary section of the wall of a coffer-dam. The construction shown in said figures is made of beams which are alternately simple and compound in their structure—that is to say, one of two adjacent sections consists of a single beam, while the other consists of two bars or members, which are riveted or bolted rigidly together. The preferable form of sections or beams which go to make up pile structure, as shown in said Figs. 1 and 2, consists of alternately-arranged I-beams A and compound beams B. Said compound beams are composed each of two similar channel-bars *b b*, secured rigidly together by means of stud-bolts or rivets b^2, with their flanges *b'* directed inwardly or toward each other. The edges of the flanges *b'* of said channel-beams when the compound beam is assembled are separated a distance slightly greater than the thickness of the web of the I-beam A, the stud-bolts being for this purpose constructed to hold said channel-beams rigidly at the desired distance apart. As herein shown, the ends of said stud-bolts are reduced to form shoulders thereon which engage the webs of the channel-bars, and the stud-bolts are secured to the webs by riveting. The webs of the I-beams are adapted to enter the spaces between the approximate edges of the flanges *b'* of the channel-beams, and the laterally-directed flanges *a* of the heads of said I-beams when the structure is assembled rest against the inner faces of the flanges of said channel-bars. The said stud-bolts b^2 are located so near the flange of the channel-bars as to leave only sufficient space for the passage of the

flanged sides or heads of the I-beams, so that they serve to hold the same in contact with the flanges of the channel-bars. The sections or beams thus made and connected may be used to form a continuous sheeting for a coffer-dam, such as is illustrated in Fig. 1, or for a retaining-wall for other purposes, as dry excavation, or used to form a tubular hollow pile or pier, such as is shown in Fig. 3.

The webs of the beams and bars constituting the simple and compound sections are rounded at their lower or advance ends and the flanges of said beams and bars terminate above said rounded advance ends formed by the central or web portions thereof, so as to reduce to a minimum the resistance of the ground to the driving of the beam. The rounding or beveling of the corners of the I-beams A facilitates the driving thereof, because insuring the free passage of the heads of the said I-beams past the stud-bolts in the compound beams B.

First describing the construction shown in Fig. 1, C C designate what may be two angularly-connected walls of a coffer-dam, said walls being, as herein shown, made of the alternating simple and compound beams A B, heretofore described, said beams being driven at their lower ends into the river-bed. In constructing the wall of a coffer-dam like that shown in Fig. 1 the compound beams made up by the two connected channel-bars are first riveted or bolted together in the manner shown in Fig. 2. The work of building the wall is begun by first driving into the river-bed a single beam, preferably a compound beam, in the position which it is to occupy in the completed dam. The next adjacent pile-section—as, for instance, an I-beam A—is inserted with the lower end of one of its flanged sides or heads into the upper end of the tubular or compound beam, the web of said I-beam passing into and through the space between the adjacent edges of the flanges of the channel-bars and the flanged head thereof between the flanges of said bars and the studs or rivets b^2. It will be thus seen that the longitudinally-interlocking connection constitutes a guide for the I-beam, so as to insure the same being driven into its proper place. Similarly after the I-beam has been driven to its proper depth a second compound or tubular beam will be placed with its lower end over the exposed flanged head or side of the I-beam and driven into place, the flanges of said I-beam and the stud-bolts thereof constituting a guide for said compound beam as the latter is driven into place. Each beam last driven therefore constitutes a guide for the next succeeding beam to be driven, thereby insuring the proper alinement of the work. The connection between two connected angularly-located walls, as the side and end walls of the coffer-dam, is formed by means of an I-beam E, Fig. 2, the web of which is bent longitudinally of the beam to give the beam as a whole an angular form. The connection of the flanges of the said beam E thus made with the flanges of the adjacent compound or tubular beams B is the same as in the case of the beams heretofore described.

The beams, when constructed and connected together in the manner described to constitute a coffer-dam or quay-wall, may be bound together near their upper ends by means of the usual wales F G, which are rigidly attached by means of brackets *f g* to the beams, said brackets being riveted to the flanges of said I-beams and to the webs of the compound beams. The adjacent ends of the wales F G may desirably be connected together by means of an angle-plate H, riveted to the webs of said wales, and thereby constituting a rigid connection between the same. When the coffer-dam to be constructed incloses a limited area and is located in relatively shallow water, so that the inward pressure of the water against the wall is not great, the construction shown in Fig. 1 is preferable, by reason of its simplicity and the economy of its construction. If desired, two or more binding-wales may be employed, located one above the other and connected to the walls of the structure and each other in the manner shown. It will be understood that in constructing a coffer-dam like that shown in Fig. 1 the pile sections or beams are first driven into place to surround an area of the river-bed. Thereafter water is withdrawn from the coffer-dam a short distance below the position at which the wale is to be located and the wale thereafter secured in place. If a second or third wale is to be employed, it will be secured in place in the same manner. It will therefore be observed that the full inward pressure of the water outside the coffer-dam is not exerted on the wall until after the construction is completed by securing the wales in place. The several beams or sections constituting the sheet-piling are provided at their upper ends with holes, affording means for attaching thereto lifting apparatus when it is desired to withdraw the piling.

Where the coffer-dam is adapted to inclose a larger area of the river-bed, or in the event of locating the same in water of considerable depth, it may be desirable to additionally support the walls from within. For this purpose I may locate inside the walls, at suitable distances apart, a plurality of tubular piles I, separately shown in Fig. 3 and shown as embodied in a coffer-dam construction in Fig. 6. When such piles are employed, the piles are first located at the desired distances apart, and thereafter the wales F G are secured to the piles, said wales being secured to the piles in this instance instead of to the piling-sections of the wall. Said wales are secured to the tubular piles by means of brackets *i*, as indicated in dotted lines in Fig. 6. The beams constituting the wall are then driven into place in the manner described, the wales in this method of con-

struction constituting guides by which the beams or sections of the sheet-piling are held in place while being driven.

The structure of the tubular pile, which is more clearly shown in Fig. 3, is essentially the same as that of the coffer-dam, with the exception that it is made of a less number of parts and incloses a smaller area. Said tubular pile consists, as shown in Fig. 3, of four compound beams or sections I′, made up of channel-bars in the manner of the like beams heretofore described, and one arranged on each side of the pile, and four I-beams I^2, which are longitudinally bent to form the corners of the pile and the heads of which have interlocking engagement with the flanges of the channel-bars, constituting a compound beam, as in the construction heretofore described.

It will be understood that the tubular pile shown in Fig. 3 may be used for various purposes—such, for instance, as a supporting-pile for building foundations, for wharves, or like structures. When such construction is employed as a permanent pile, its interior will be filled with concrete or like substance, which upon hardening adds great strength to the pile.

It is furthermore obvious that by increasing the size, as shown in Fig. 3, the same may be made to answer the purpose of a pier for the supporting-bridges or like structures in a river-bed or elsewhere. Inasmuch as permanent tubular piles or piers made as described are in themselves novel this feature of construction is claimed separately as part of my invention.

When the sheet-piling hereinbefore described is embodied in the wall of a coffer-dam or like structure, and it is therefore essential that the same shall be constructed to exclude water, I may for the purpose of making such water-tight joint between the parts constituting the wall fill the compound or tubular section of beam B with clay or like material. As a more effective and certain means for producing such water-tight joints between the parts of the piling I have shown in Figs. 4 and 5 modifications of the form of the beams, whereby they are provided in the joints between the same with openings or spaces for the introduction of packing. I have also shown a form of packing, consisting of wood or like material, inserted in the said spaces. As shown in Fig. 4, the flanges b^3 of one of the channel-bars is disposed obliquely with respect to the web of said bar in such manner as to form between said flanges and the adjacent parts of the head and web of the I-beam a packing-space triangular in cross-sectional form and adapted to receive a packing-strip b^4 of wood or like material. In Fig. 5 the flange b^6 of one of the channel-bars b of the compound beam is formed to constitute two sides of a rectangle and forms between the same and the adjacent web and head of the I-beam a substantially rectangular space adapted to receive a like shaped packing-strip of wood or like material. In view of the fact that such joints are required where the piles are submerged in water, wood or other material which expands when brought into contact with water is preferably employed as a material for the packing-strips. In both of these constructions the wedging of the strips when the expansion of the packing-strips takes place not only affords a water-tight joint between said strips and the associated parts, but also serves to draw the oppositely-located channel-bars into close relation to the I-beams.

I claim as my invention—

1. Metallic sheet-piling consisting of metal beams, the meeting edges of which are provided with interlocking parts consisting of lateral flanges and longitudinal undercut grooves, said grooves being shaped to provide spaces or openings for the insertion of packing-strips.

2. Metallic sheet-piling consisting of I-beams and compound beams formed each of two channel-bars connected by stud-bolts, one of the said channel-bars of each beam being so shaped at its margins as to provide spaces for packing-strips between the flanges thereof and the adjacent head of the I-beams engaged therewith.

3. The combination with retaining-walls, each constructed of sheet-metal piling comprising metal I-beams and compound beams consisting of channel-bars, the flanges of which are directed inwardly and which are connected by stud-bolts, of a junction-beam for joining said wall, said beam consisting of an I-beam which is transversely folded along its longitudinal center, the flanges of which are adapted to interlock with adjacent compound beams of the intersecting walls.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 29th day of October, A. D. 1900.

GEORGE W. JACKSON.

Witnesses:

C. CLARENCE POOLE,

BERTHA A. PRICE.