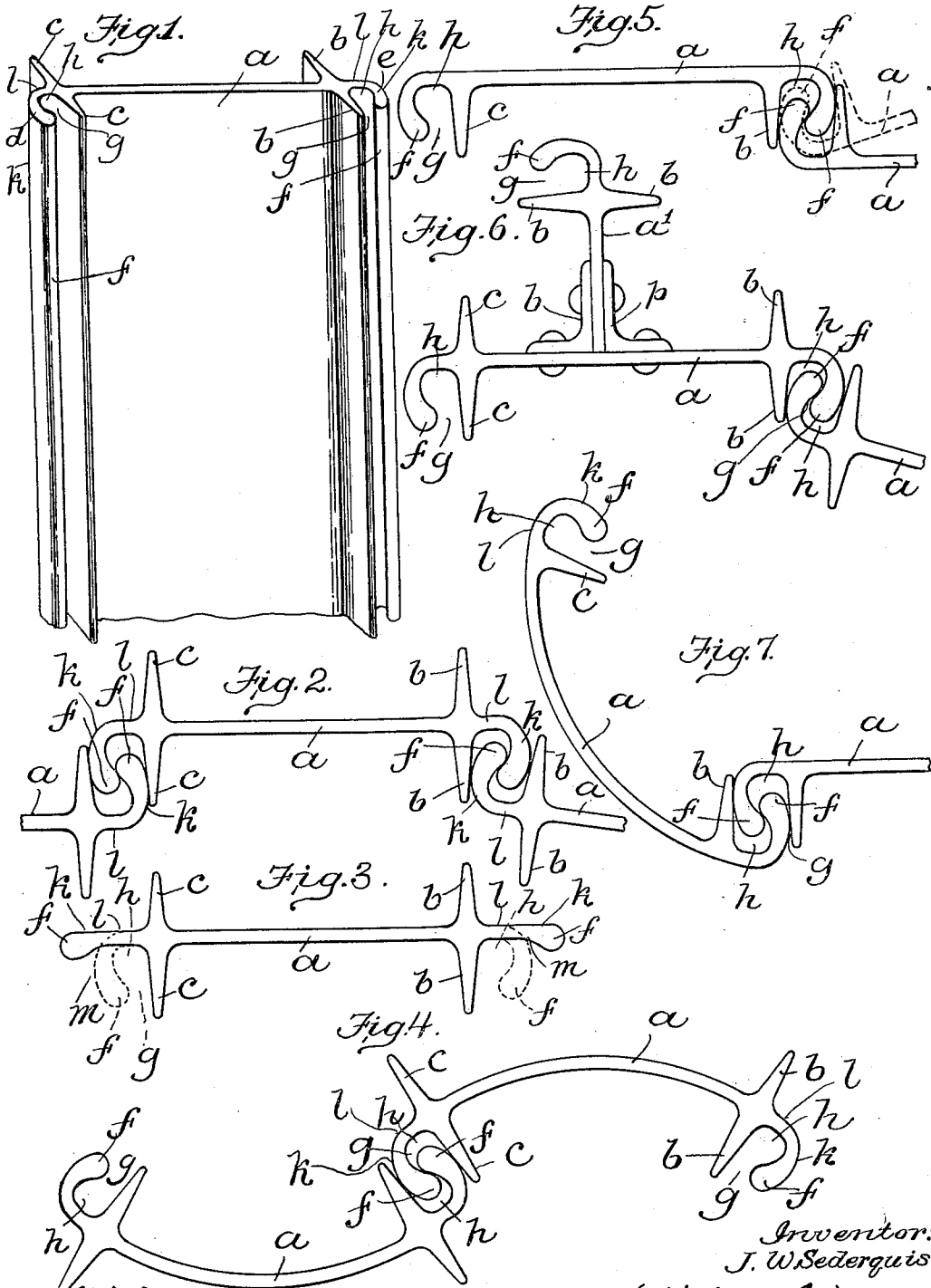


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INTERLOCKING SHEET PILING.  
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Patented July 15, 1913.



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# UNITED STATES PATENT OFFICE.

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## INTERLOCKING SHEET-PILING.

1,067,489.

Specification of Letters Patent.

Patented July 15, 1913.

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*To all whom it may concern:*

Be it known that I, JAMES W. SEDERQUIST, a citizen of the United States, and resident of Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Interlocking Sheet-Piling, of which the following is a specification.

The object of the present invention is to produce an improved form of interlocking metallic sheet piling which is easily driven in interlocked condition and when driven is efficiently sealed against leakage; to produce a pile of the character indicated of which the portion which interlocks with other piles provides sufficient clearance to permit of the piles being inclined to one another, that is, placed in other than the same plane or parallel planes; to provide a pile which is securely interlocking and provides a substantially tight joint against flow of water, but is not liable to become so tightly joined to other piles, by rust or otherwise, that it cannot be pulled easily; and, finally, to provide a pile, having the characteristics hereinbefore indicated, which can be shaped by rolling, easily and economically. The manner in which I accomplish these objects is sufficiently explained in the following specification, and the character of pile which I have designed to embody the features above set forth is sufficiently shown in the annexed drawings, to which reference is directed.

Referring to the drawings: Figure 1 is a perspective view of one end of a sheet pile made in accordance with my invention and embodying the principles thereof. Fig. 2 is an end or plan view of such pile, showing the manner in which the same is interlocked with adjacent piles. Fig. 3 is an end view of an uncompleted pile embodying my invention, showing in full lines the form of the pile before it is given its final shape, and indicating by dotted lines the final step required to complete the pile. Fig. 4 is an end view of two interlocked piles, showing one of the many forms which may be given to the pile. Fig. 5 is an end view of two interlocked piles embodying a modification of the invention. Fig. 6 is a similar view showing a fabricated section of the invention for a particular purpose. Fig. 7 is a view of a modified form of the pile shown in Fig. 5. The same reference characters indicate the same or similar parts in all the figures.

The pile in its preferred form comprises a web *a* which constitutes the main portion or body of the pile, stiffening and anchoring flanges *b*, *b* and *c*, *c*, and locking members *d* and *e*. These locking members are located at the extreme edges of the pile, while the stiffening flanges *b*, *b*, *c*, *c*, are near but somewhat within such edges. Preferably the stiffening flanges extend perpendicularly from the plane of the central or body portion of the pile, and those projecting from one side of the pile are in approximately the same plane with the corresponding flanges projecting from the opposite side of the pile. The flanges are beveled or tapered, that is, they diminish in thickness from their bases to their outer ends or edges, as shown best by the end views. I call those parts of the flanges which join or merge with the body of the pile the bases of the flanges.

Preferably the pile is formed by being passed successively between rolls of proper form in the same manner as heretofore usually practised in the manufacture of integral rolled sheet piles, the pile being finally produced from successive operations performed on a billet or bloom. The rolls which act successively on the developing pile are formed so as gradually to reduce the thickness of the central or body portion of the pile and to develop the stiffening flanges or ribs *b*, *b*, *c*, *c*. The edge portions of the piece beyond such flanges are also rolled into shape, diminished in thickness, and formed at the extreme edges with a thickened bead or bulb *f*. The shape of the practically finished pile before its final passage through the finishing rolls is substantially as shown in Fig. 3, where the width and thickness of the body and edge portions of the pile, the form of the beads or bulbs *f*, and the dimensions and forms of the flanges or ribs have the predetermined desired values.

The final operation upon the pile is to pass it between finishing rolls which are so formed and arranged as to bend the edges over substantially in the manner shown by dotted lines in Fig. 3 and by full lines in all the other figures. In this final forming operation the dimensions of the members of the pile are not altered in the least and the only change is that given to the shape of the projecting edges, which instead of projecting straight outwardly, are bent over

with the bead on the turned over portion being the part of such portion which is nearest to the adjacent flange or rib. The edges formed as above described constitute the means for providing an interlock with other piles, and the formation and dimensions of these interlocking portions are of the greatest importance. Such form and proportions must be substantially in accordance with the following specifications in order that the pile may be practically useful and satisfactory. In order to conduce to a better understanding of my invention I will give here the essential characteristics which a sheet pile must possess in order to answer my purposes. First, the lock must be sufficiently free to permit the piles to be easily driven without binding or cramping. Second, the lock must be of such a character that the piles cannot separate in any direction. Third, the lock between adjacent piles should be sufficiently close to reduce the leakage of water to the minimum and at the same time be not too close to permit the piles to be pulled readily when their period of use is ended. Fourth, there should be freedom for the piles to swing or turn angularly with respect to one another through a sufficiently wide angle about their interlocked parts in the manner of a hinge. My pile possesses the foregoing essentials by reason of the propinquity of the flanges *b* and *c* to the adjacent turned-over edges, because such edges are so bent over that the distance between the nearest point of the bead or bulb *f* and the adjacent flange is less than the width of any other part of the space inclosed between the turned-over edge and the said flange. Thereby, when two piles are interlocked with the thickened edge or bead of each in the space provided between the turned-over part and the flange of the other, there is no room for the beads thus interlocked to be withdrawn except lengthwise of the pile. At the same time, the length of the inclosed space between the bent-over edge and the flange is greater than the length of the bead, thus there is sufficient clearance.

The opposite edge portions of any pile are duplicates of each other and are essentially alike in all forms or embodiments of the pile. For the purpose of defining and explaining the terms used in the following claims I will describe one of such edge portions in detail, and will identify each of the elements of the same by a characteristic term. The thickened part at the extreme edge of the pile I have already called a bead or bulb *f*. Such bead forms one boundary of the mouth *g* of the space *h* inclosed between the rolled-over edge and the adjacent flange. Such space I prefer to call a groove. That part of the turned-over edge which forms the outer boundary

of the groove and is designated *k* I call a wall, and the portion of the pile which joins such wall *k* with the body of the pile, and to which the reference letter *l* is applied, I call a web. The part *b* (and similarly the part *c*) which I have heretofore called a flange I also term a stop, because it forms an abutment or stop making contact with the locking portion of the adjacent pile. The groove *h* thus bounded between the stop *b*, the web *l*, the wall *k* and the bulb *f* is wider between the stop *b* and the wall *k* than the thickness of the bulb and longer than the length of the bulb. The terms "longer" and "length" as used in this connection have reference respectively to the dimension of the groove from the web *l* to the mouth or narrowest part *g* of the groove, and to the extent of the bulb from the point where the latter springs from the wall *k* to the extreme outer edge of the bulb. This point is most clearly indicated at *m* in Fig. 3. The width of the mouth *g*, which of course is greater than the thickness of the wall *k*, is less, as already indicated, than the combined thickness and inward offset of the bulb *f*. Thus there is ample clearance for the piles to be driven after being interlocked, without their interlocking parts cramping or binding; and there is a space between the bounding walls of the groove and the end or extreme edge of the inclosed bead. This enables one pile to be swung about the lock to either side of a plane parallel to the main or central portion of the web, as indicated at the right-hand portion of Figs. 2 and 6 in full lines and in dotted lines at the right-hand portion of Fig. 5. Thereby connected piles may be turned with respect to one another to form a curved wall. The amount by which one pile can thus swing relatively to another is limited by the flange or stop *b*, against which the outer or back face of the bead and of the wall *k* comes into contact. It is on account of this function of stopping the swing of the pile that I term the part *b* a stop.

In driving the piles, the sand, clay, gravel, etc., through which the pile is forced naturally tend to enter the locking grooves and to force their way into the clearance space between the web *l* and the adjacent end of the inclosed bulb. The pressure of this material has the effect of tending to crowd the bulb outward from the groove as far as permitted, and until the opposite sides of the bulb on one pile come into contact with the bulb and the flange or stop of the other pile adjacent to the mouth *g* of the groove. As the opposite surfaces of the bulb which thus come into contact with the walls of the groove are gradually tapered, the bulb acts as a tongue or wedge which is crowded tightly into the gradually tapering mouth

of the groove and makes a two-point tangent contact therewith. There being but two tongues at each locking point, each with two points of tangent contact, and one of these points being common to the two tongues, when the piles are straight, that is, all in substantially the same plane, or parallel to the same plane, there are thus three points of contact between two piles at each locking point. There is thus provided a seal against leakage of water from one side of the interlocked piling to the other which is very efficient. The tangent contact areas are very limited, whereby the total pressure between the piles is concentrated and made intense to make a tight joint, without permitting the parts to become permanently bound together by the formation of rust at the points of contact. In some designs of piling which have extended areas of contact at the locking points, difficulty has been experienced on account of a tendency of the piles to become so securely united together by the formation of rust that they could not be pulled up when their period of use was ended. On account of the wide clearance and narrow bearing areas in the interlocked portions of my piles, there is no difficulty in pulling up the piles after use, but they may be removed very readily.

It is not essential to my invention that there be flanges *b*, *b*, *c*, *c* on opposite sides of the pile. On the contrary, the essential principles of the invention may be embodied in a pile having such flanges on one side only, as shown in Figs. 5 and 7. The piles may also be made in many diverse forms, for instance, by being bowed transversely, as indicated in Figs. 4 and 7. My design of pile is capable also of being fabricated to provide for corners and partitions in a coffer dam or other structure in which the piling is used, as indicated in Fig. 6, where a partial pile *a'* is connected to the central part of a complete pile by angles *p*.

The ribs *b* perform many functions in my pile. They are stiffening flanges which give to the pile greatly increased resistance to bending, they are anchoring members which resist any tendency of the pile to shift after being driven, and they are stops, each of which forms one of the boundaries of a locking groove.

What I claim and desire to secure by Letters Patent is:

1. Interlocking sheet piling comprising members each of which has its edge portion bent over to form a laterally projecting tongue and has a stop projecting perpendicularly from the body of the pile adjacent to and beside such tongue, providing between itself and the tongue a groove, the groove being wider than the tongue and being longer than the tongue from the mouth to

the inner limit of the groove, whereby clearance is provided between the tongue and the boundaries of the groove, permitting variation in angular placing of interlocked piles.

2. Interlocking sheet piling consisting of bodies each having a stiffening flange near and parallel with its edge and having a strip outside the flange thickened at its edge to make a bead and bent over beside such flange, the space between the bead and the nearest point of the flange being narrower than any other part of the space inclosed by such bent-over strip, and the distance between the bead and the junction of such strip with the pile body being greater than the length of the bead.

3. Interlocking sheet piles each having a flange and an edge strip bent over beside the flange and provided with a bead on the extreme end or edge, the edge strips of the piles being interlocked, with the bead of each contained between the web portion and the flange of the other; the bead of each being confined between the bead and the flange of the other, with a clearance providing for angular adjustment of one pile relatively to the other.

4. A sheet pile including in its construction a web projecting at the edge of the pile and in the same general direction as the body part of the pile, a stop extending substantially at right angles to said web, a wall extending from the web in the same general direction as and beside the stop, and a bulb or tongue on the edge of such wall having its inner surface nearer to the adjacent stop than any other point of said wall, and the area of the space inclosed between the stop, web and wall being greater than the transverse area of the bulb itself, whereby a clearance space is provided permitting interlock with another pile and freedom of movement of the bulb of such other pile in such space.

5. A sheet pile consisting of a body, a stiffening flange projecting laterally of the body near its edge, a web projecting longitudinally of the body beyond the flange, a wall projecting laterally from such web beside and approximately parallel to said flange, and a bead on the edge of said wall having a greater thickness than the wall and located with its side next to said flange at a less distance from the flange than any point of the wall, which distance is greater than the thickness of the wall.

6. A sheet pile having near its edge an outwardly projecting longitudinal stiffening flange, and at its edge a longitudinal tongue bent over beside the flange and inclosing a groove between itself and the flange, the mouth of such groove being narrower than the thickness and inward projection of a bead on the edge of such tongue and wider than any other part of the tongue, and all

the transverse dimensions of the groove being greater than the corresponding dimensions of said bead.

7. A metal sheet pile comprising a body  
5 with laterally projecting flanges near its edges, constituting a beam, and having outside of its flanges edge portions, each of which is rolled over and back toward the adjacent flange, inclosing a groove of which  
10 the mouth is narrower than any other part, and of which the length beside the flange, and the width, are greater than the corresponding dimensions of the rolled-over edge portion, whereby a flexible joint for inter-  
15 locking with another similar pile is provided.

8. A metal sheet pile having a substantially plane central portion, and having a locking portion consisting of a web joining said central portion in the same plane with  
20 the latter, and an edge rolled over to one side from such web and backwardly, and the pile having also a stop projecting laterally beside such edge, the space inclosed between the stop, edge, and web having greater  
25 dimensions than the rolled-over edge.

In testimony whereof I have affixed my signature, in presence of two witnesses.

JAMES W. SEDERQUIST.

Witnesses:

ARTHUR H. BROWN,  
PETER W. PEZZETTI.

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