No. 863,886. PATENTED AUG. 20, 1907.

F. W. SKINNER.

METAL SHEET PILING.

APPLICATION FILED AUG. 3, 1905.

2 SHEETS—SHEET 1.

Fig. 1

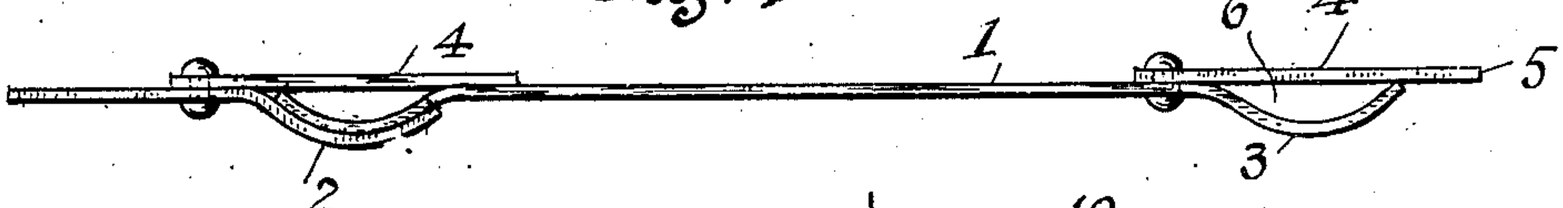


Fig. 2.

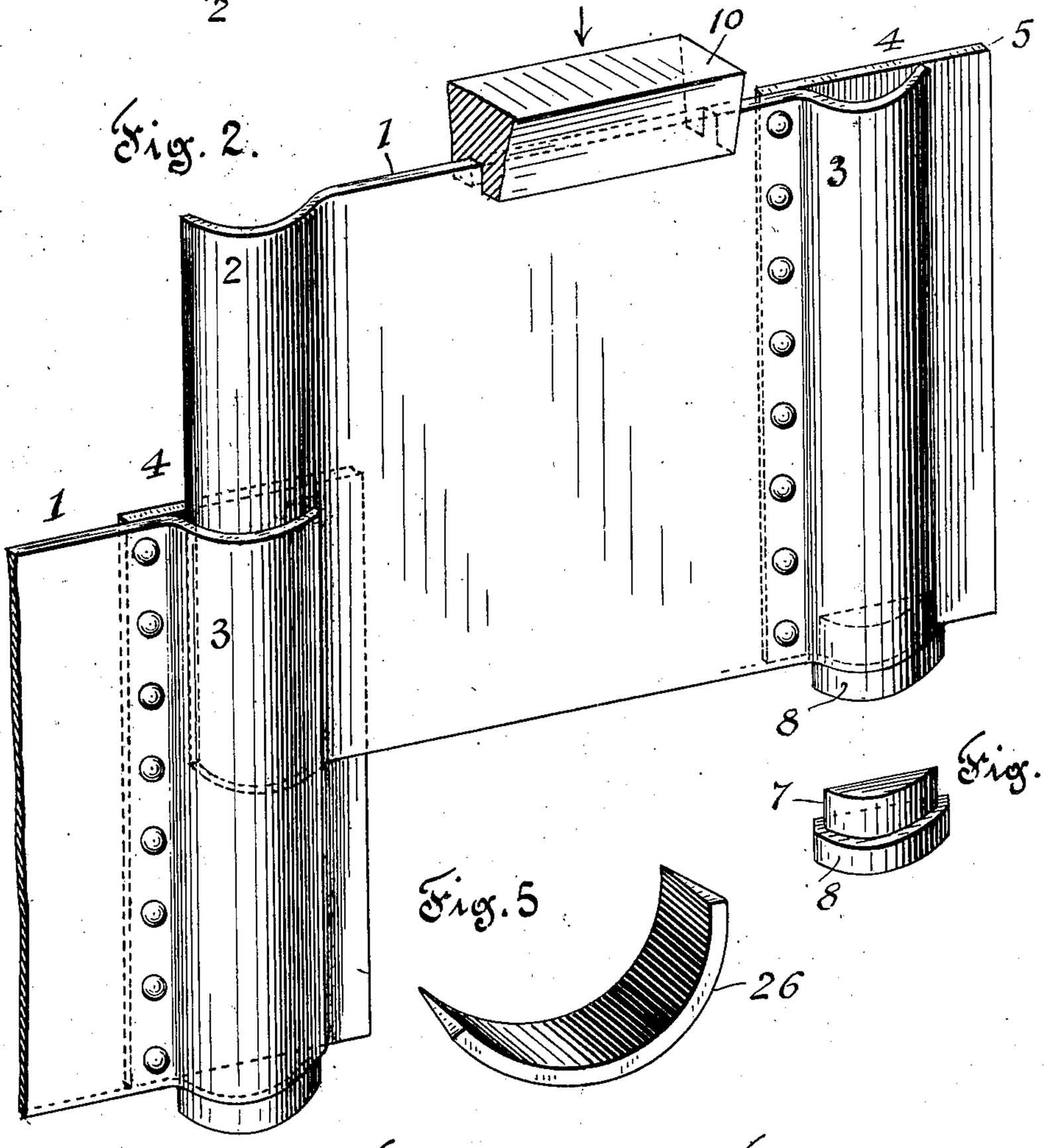


Fig. 6.

Fig. 5

Fig. 3.

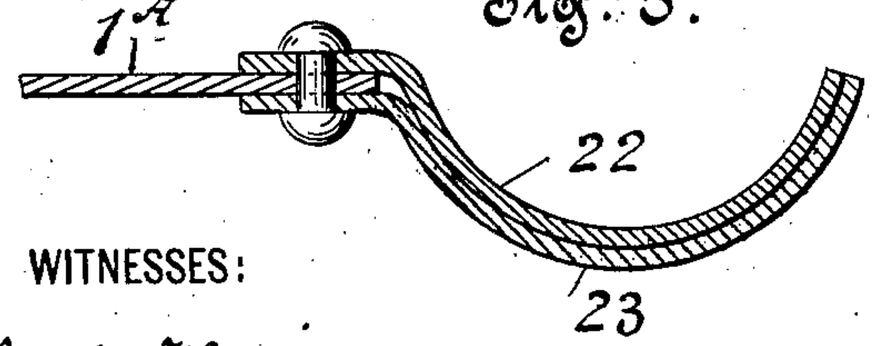
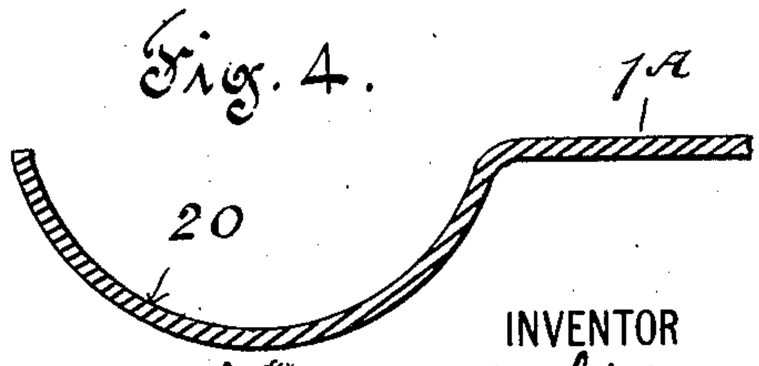


Fig. 4.



WITNESSES:

Charles Kanimann

Henry V. Brown

INVENTOR

Frank W. Skinner

BY

Walter Brown

his ATTORNEY

No. 863,886. PATENTED AUG. 20, 1907.

F. W. SKINNER.

METAL SHEET PILING.

APPLICATION FILED AUG. 3, 1905.

2 SHEETS—SHEET 2.

Fig. 8.

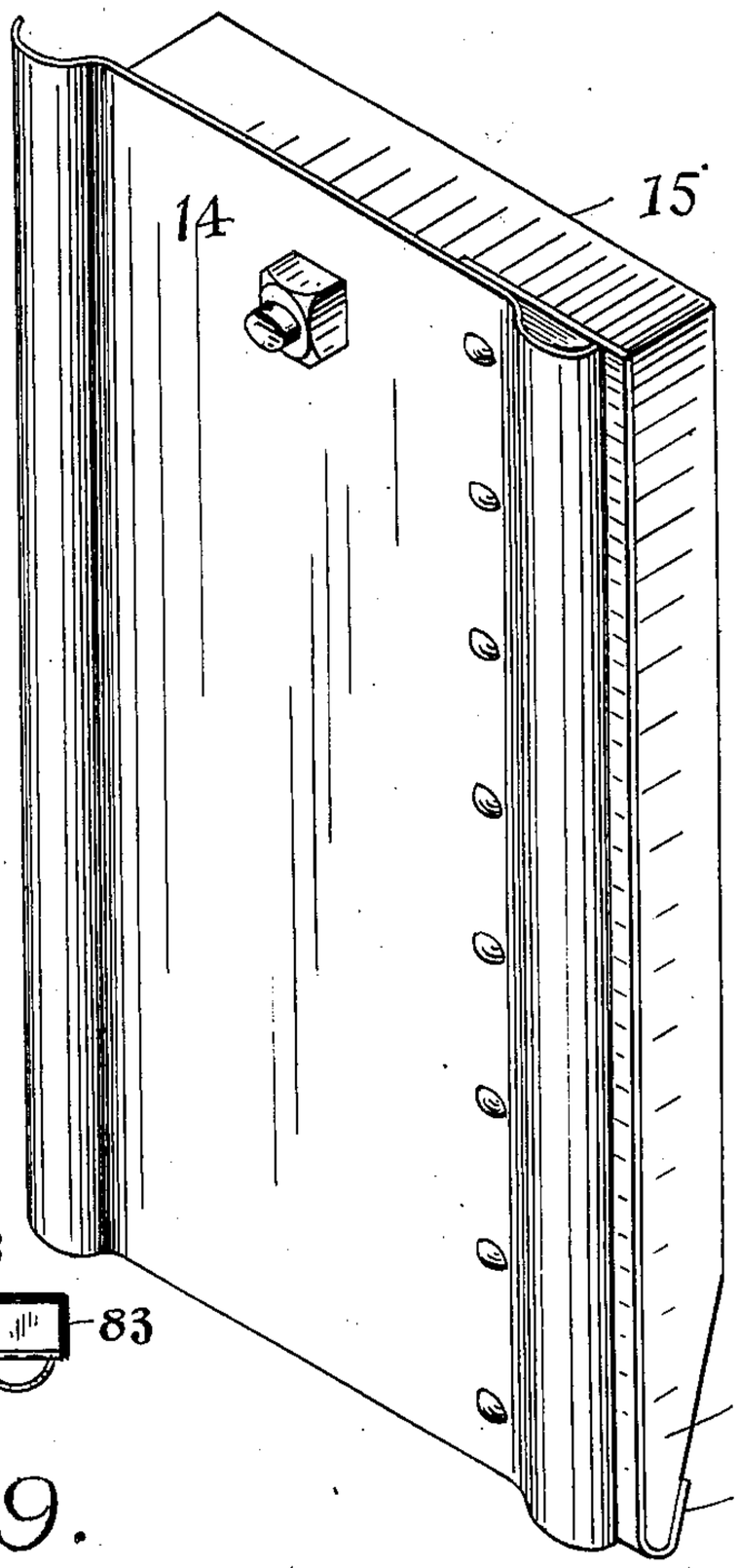


Fig. 10.

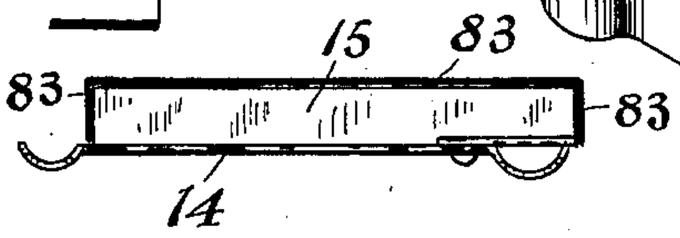


Fig. 9.

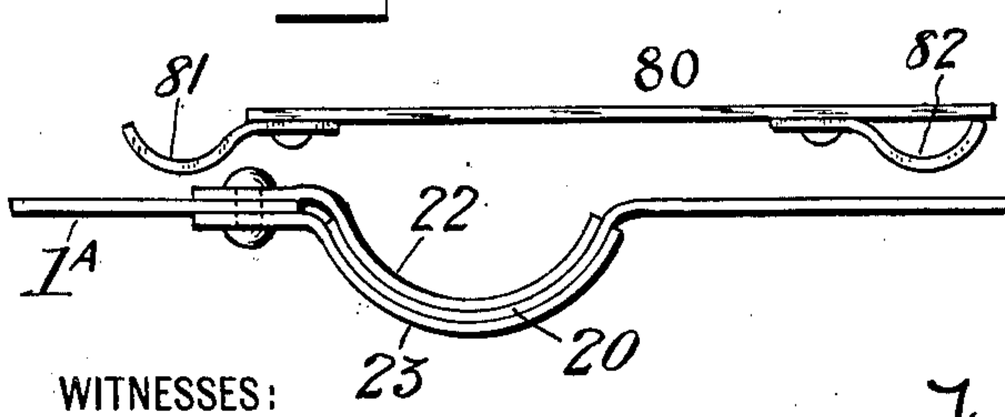


Fig. 7.

WITNESSES:

Charles Hanimann

Walter R. Harris

INVENTOR

Frank W. Skinner

BY

D Walter Brown

his ATTORNEY

UNITED STATES PATENT OFFICE.

FRANK W. SKINNER, OF NEW YORK, N. Y.

METAL SHEET-PILING.

No. 863,886. Specification of Letters Patent. Patented Aug. 20, 1907.

Application filed August 3, 1905. Serial No. 272,465

To all whom it may concern:

Be it known that I, FRANK W. SKINNER, a citizen of the United States of America, and a resident of the borough of Richmond, city of New York, State of New York, have invented certain new and useful Improvements in Metal Sheet-Piling, of which the following is a specification.

This invention relates to improvements in metal sheet piling and similar structures for use in underpinning, retaining walls, foundations, coffer dams, cut offs, core walls, tunneling shaft sinking and general construction.

It aims to provide structural units or sections, which can be easily driven and connected with each other by water tight joints, and is adapted equally to separate piles, and to sheet piling and the various special and general constructions above mentioned.

It is designed to secure the simplest, most economical and efficient construction, and to be made from commercial materials, to provide tight and reliable joints, and to be suited to all the purposes and conditions which arise in ordinary practice and require various qualities in the piling. In the simplest type I use a flat plate with a water-tight spring lock joint of simple construction riveted to one or to both edges of each pile. When both edges of the pile are provided with the spring lock joint, other sheet piles will be provided with suitable devices to interlock therewith, and when the spring lock is provided at one edge of the pile the other edge thereof will be formed to interlock with the lock of the adjacent section of piling. This joint especially utilizes the spring principle of both bent and straight plates, and is more efficient and economical than any previously made.

Where it is desirable to drive a very thin sheet pile which has not sufficient rigidity to endure driving unaided, I provide a temporary driving backing which is removable after it has driven the sheet pile to position.

When it is necessary to provide increased thickness to the sheet pile, or to give it lateral stiffness, I make it in the first instance of two pieces of bent or curved plates riveted together and with their separated vertical edges curved to form an adjustable spring lock joint, somewhat like a ball and socket joint.

To increase the stiffness of single plate piles I give them a curved or bent cross section, and I utilize the commercial corrugated sheets which are well known, both in single and in double sheets, as set forth and claimed in my divisional application filed in the United States Patent Office November 25, 1905, Ser. No. 289,050, differing the joint from the ordinary lap well known, by adding a second thickness of the metal riveted on with or without a filler to make a pair of jaws or female part to receive the other part, and also provide concrete, clay or other filling for the joints and hollow spaces, or leave them empty as conditions may require, and either form the lower ends of the open hollow spaces to exclude the earth when driving, or provide closures for them, as may be preferred in any case.

The spring lock joint is applicable to a variety of constructions as well as to piling, and constitutes a very useful feature of the invention, for it provides means of connecting members of various constructions together with water-tight joints, which allow of considerable deflection of the members, whereby they may be carried around curves, in zigzag lines and in any required direction, without diminishing the efficiency of the joints.

Among other important advantages of the invention therefore are that it provides firm water-tight locks between the several sections or units of the piling, that it permits of the use of commercial corrugated sheet steel for the sections, that it provides simple means for excluding the earth from the locks and hollow spaces of the piles when necessary, provides simple devices for opening the locks to engage with the next section of piling, provides for stiffering or reinforcing the sheet piling so that it can be driven whenever such stiffening or reinforcement is necessary, and for removing the reinforcement after the sheet has been driven down.

Other important advantages will be apparent from the description of the invention hereinafter given.

Referring to the drawings which accompany the specification to aid the description, Figure 1 is a plan of a unit of straight sheet piling with one form of single spring lock, termed a "single spring cement lock", and Fig. 2 is a perspective view of two similar sections partly interlocked. Fig. 3 is an enlarged section of a form of double spring lock, and Fig. 4 a section of the interlocking end of the next sheet. This lock is termed the "double friction spring lock". Fig. 5 is a perspective view of a wedge for opening the lock of Fig. 3, and Fig. 6 is a perspective of plug for the lock of Fig. 1 and 2. Fig. 7 is a plan of a straight sheet equipped with the lock of Fig. 3. Fig. 8 is a perspective view of a unit of piling with removable reinforcing back. Fig. 9 is a top view of a modification of the lock of Fig. 1. Fig. 10 is a plan view of a section of sheet piling provided with a driving backing having cover plates to facilitate withdrawing the backing after the piling is driven.

Referring to Figs. 1, 2 and 6, a sheet of steel or other suitable material of desired thickness, is provided by

rolling or otherwise with curved longitudinal edges, 2, which are usually but not necessarily the vertical edges, one of which is adapted to interlock with a lock on the adjacent edge of the next unit, or section, of the piling and the other is spanned by a long narrow flat plate 4 riveted to sheet 1 as shown, and preferably having a projecting edge 5. The bottom of the lock may be closed by a shouldered plug 7, 8 to prevent earth from entering the interior of the lock. The sheet 1 may have the spring locks at both ends, and other sheets or sections may be provided with devices to engage said locks, and the sheet pile may originally be formed as a plain flat sheet, as 80 Fig. 9, and both members 81, 82 of the spring lock joint may be riveted on as indicated in that figure.

When the plate is stiff enough to drive without backing one section will be driven in the usual manner, a removable block 10, which is provided with a grooved under side to fit the sheet pile, being placed on the pile during the driving. Then the upper end of the lock will be sprung open by any suitable tool, the curved edge 2, of the next section inserted therein and the said next section then driven home, the bottom of its lock being protected by a plug as was the lock of the first section; and thus, section by section, the piling is interlocked and driven. Finally the interior spaces of the locks may or may not be filled with cement, grout, clay or any other suitable material, to make them water-tight or not, as desired. Obviously, this operation may be modified by driving the piles with the male or interlocking part of the joint on the advance edge, so that the double jaw or female part shall be on the section next driven, and in that case this section would be driven without the protecting bottom plug, and would be likely to become filled with earth etc. as the piece is driven.

When a sheet, as 14 (Fig. 8—) is too thin to drive without reinforcement I provide removable backing as follows: The lower edge of said sheet 14 is bent around upward as at 17. Then a block 15 of steel or other material, with its lower end, preferably chamfered as at 18, is fitted into said turned up end at the bottom and bolted to sheet 14 at the top, and the whole driven. The top of block 15 is then unbolted from sheet 14 and the backing 15 pulled up, having been first greased to permit it to come the more easily. Another section provided with a removable backing is then interlocked with the first section, and driven, and so on. The removable driving backing may be greased, and may have its bearing surface grooved or ribbed to reduce the friction. It may also be provided with cover plates as 83, 83 on any or all of the sides not covered by the sheet pile to reduce the resistance to withdrawing it as indicated in Fig. 10. Obviously different cross sections may be given to the backing to conform to curved or bent piles and to increase its own stiffness, the simplest form only is here shown, but the use of the backing in any form is claimed. The backing may be left in position and not withdrawn until after the adjacent pile is driven. I do not however herein specifically claim the driving backing, since the same is claimed in my divisional application.

The lock of Figs. 1, 2, 8 and 9 may be made water-tight by cement or other material, and I therefore term it a single spring cement lock. But other forms of lock may be arranged to be water-tight from their own construction, as indicated in Figs. 3, 4, 7 and 9 and is then termed double spring lock or friction lock. In this case sheet 1^A has one curved edge 20 adapted to interlock with the lock on the adjacent edge of the next sheet. Said lock is composed of two similarly curved plates 22, 23, riveted or otherwise secured to sheet 1^A, so as to lie in substantial contact with each other, as indicated in Fig. 7. One member of the lock may be integral with the sheet 1^A, as indicated in the drawings. Such a section of piling may be reinforced as are the sections shown in Fig. 8 and 10, or if stiff enough may be driven without reinforcing. As the said plates 22, 23 lie in contact no plug is needed to keep the earth out of the lock. When one section of piling has been driven, a curved wedge 26, which fits between said plates 22, 23, is driven in the top of the lock to open it; the curved edge 20 of the next section then inserted, and said next section then driven, either with or without a reinforcing backing according to its stiffness. As said next section is driven down, it forces the wedge 26 before it, and finally out of the bottom of the lock into the earth. The plates 22, 23 lying in close contact with the part 20 of the interlocked section of piling make a water-tight joint without cement or other fillings. With this joint, the opening of the lock may be facilitated by omitting rivets at the upper part of the lock, and the wedge may then be dispensed with.

It will be evident from the foregoing description that the several features of my invention can be modified in details, and that the spring locks may be constructed in various ways without essentially changing the invention. Thus for example the single spring cement lock, of Fig. 1, may be constructed by applying to one edge of a plain flat sheet of steel 80, (Fig. 9), a narrow suitable curved strip 81 to form the interlocking tongue, and applying to the other edge of the sheet a corresponding curved strip 82, at such a position that said sheet 80 will span and close the lock. Said lock is the equivalent of that shown in Fig. 1, and the sheet is used in a similar manner.

Now having described my improvements I claim as my invention.

1. A joint for connecting adjacent sections of a structure, consisting of mutually engaging curved strips and a substantially flat locking strip of resilient material, substantially as described.

2. A joint for piling consisting of a curved plate and a flat plate spanning the arch of the curved plate, substantially as described.

3. A member of a lock for piling comprising a flat web adapted to be secured to a section of piling and an integral curved portion adapted to engage with the lock of an adjacent section of piling, substantially as described.

4. In metal sheet piling, the combination of units each composed of a flat member provided with marginal corrugations, one of said corrugations being nearly closed by the said flat member and coöperating therewith to lock the said units together.

5. In metal sheet piling, the combination of units each composed of a flat member arranged with marginal corrugations, one of said corrugations forming with the said

flat member a space for the reception of a corrugation of a contiguous unit, whereby the said units are locked together.

6. In metal sheet piling, the combination of units each composed of a corrugation section having one of its corrugations nearly closed by a tongue and coöperating therewith to lock the said units together.

7. In metal sheet piling, the combination of units each composed of a flat member, longitudinal corrugations at the sides thereof, one of said corrugations being of greater radius than the other, a tongue at the base of the larger corrugation coöperating therewith to lock the said units together.

Signed at New York this 1st day of August 1905.

FRANK W. SKINNER.

Witnesses:

HENRY V. BROWN,

HENRY H. DEVAS.