No. 843,307. PATENTED FEB. 5, 1907.

F. W. SKINNER.

SHEET PILE.

APPLICATION FILED JAN. 15, 1906.

2 SHEETS—SHEET 1.

Figure 1

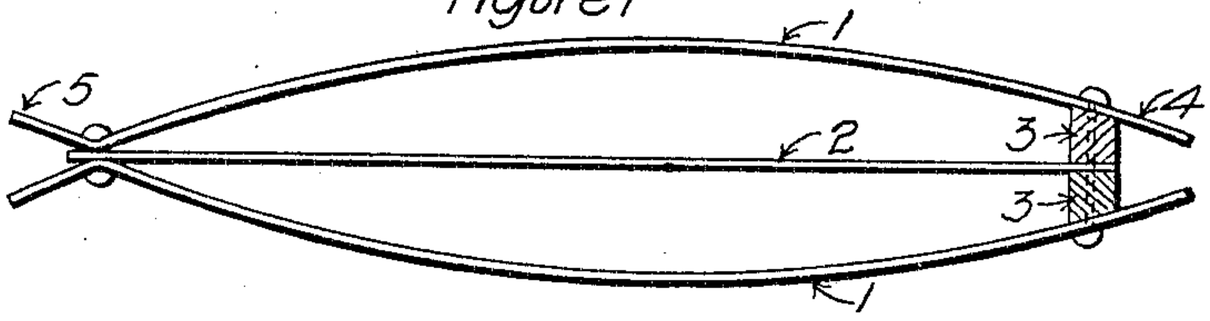


Figure 2

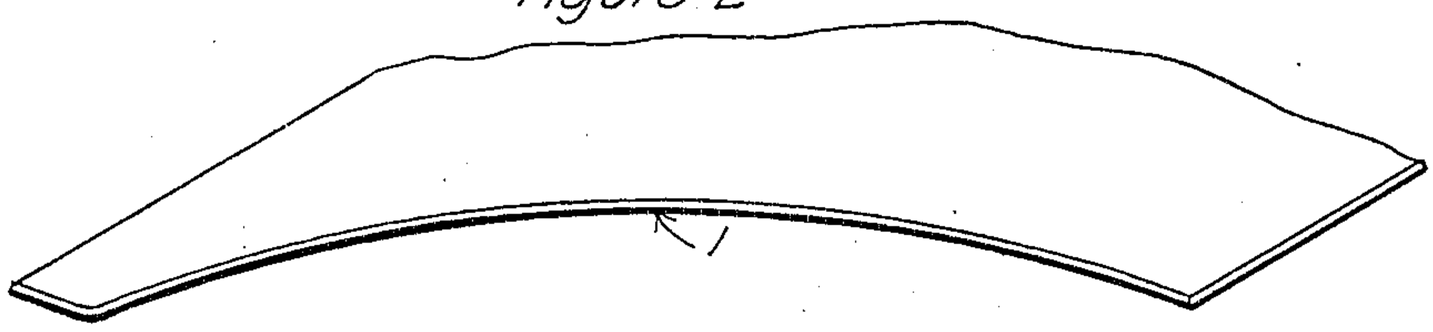


Figure 3

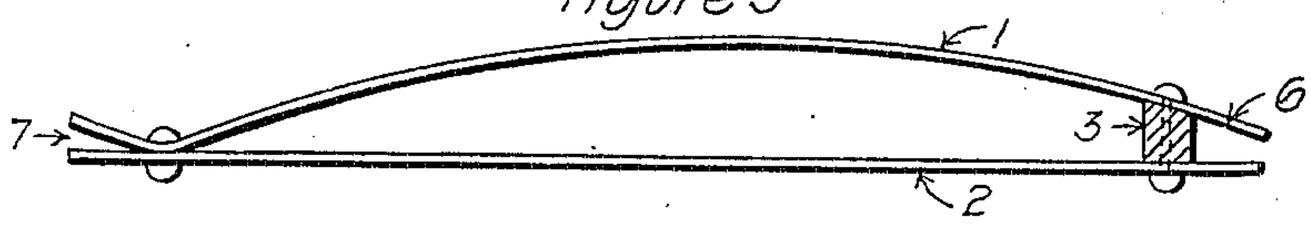


Figure 4

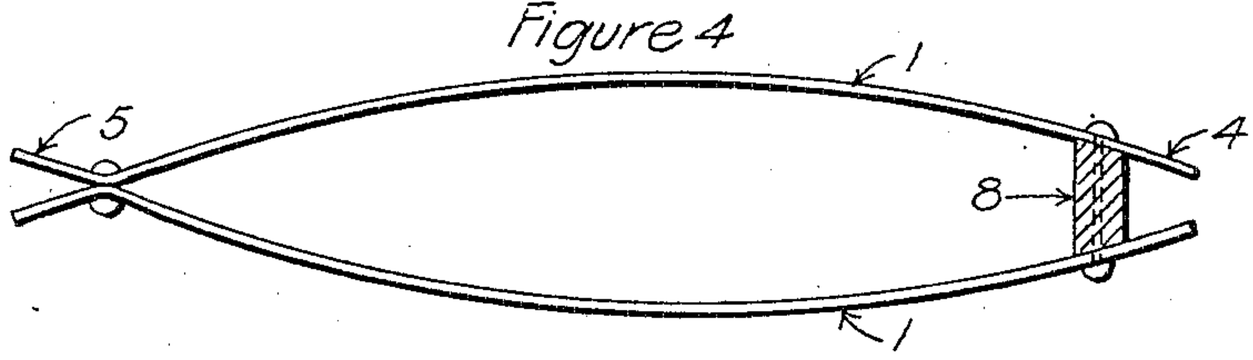


Figure 5

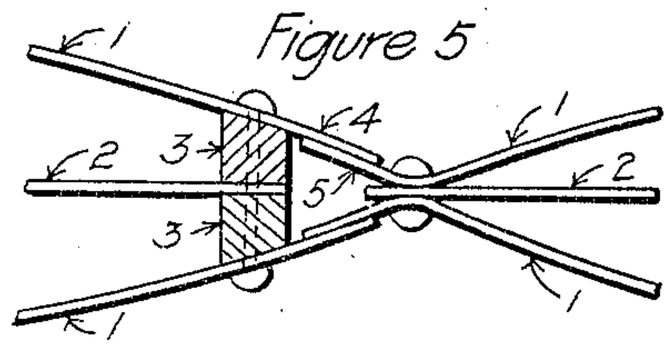
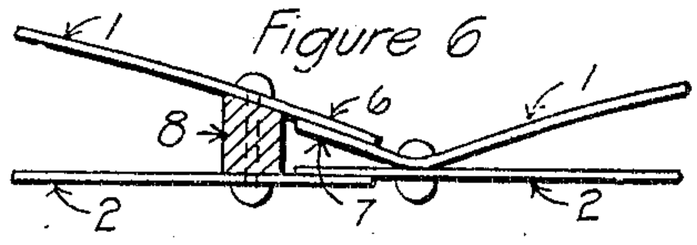


Figure 6



WITNESSES:

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Walter D. Harris

Frank W. Skinner.
INVENTOR

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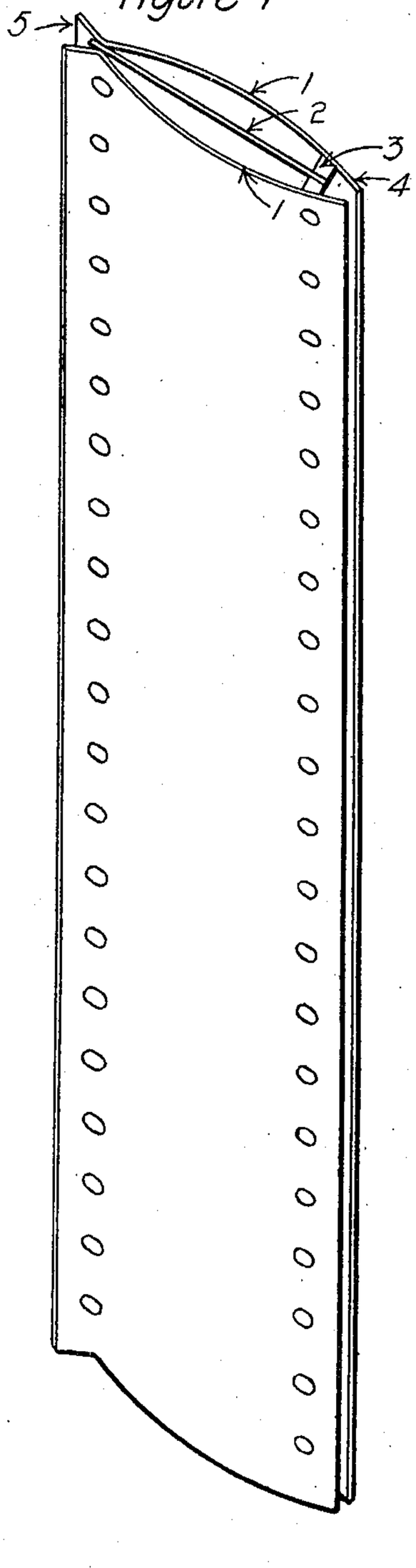
2 SHEETS—SHEET 2.

Figure 7



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UNITED STATES PATENT OFFICE.

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

SHEET-PILE.

No. 843,307. Specification of Letters Patent. Patented Feb. 5, 1907.

Application filed January 15, 1906. Serial No. 296,107.

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, in the city of New York, State of New York, have invented certain new and useful Improvements in Sheet-Piles, of which the following is a specification.

This invention relates to improvements in sheet-piles.

It is particularly designed to increase the strength, stiffness, and efficiency of piles, to combine the greatest economy of material and manufacture, to utilize all material in the most scientific and effective manner, to secure resistance to pressure by the application of the arch principle, to provide a new and improved interlocking spring-joint of the simplest construction, and to diminish the resistance to driving.

The pile is composed of two or more plates or sheets of a suitable material, as iron or steel, one or both of which is curved or bent, so as to present a convex surface against lateral pressure. These pieces are fastened together by rivets or otherwise at or near their long edges, and their edges are arranged to form a male joint on one edge and a female joint on the other edge, or suitable joint-bars are secured to them for that purpose. Ordinarily the regular units are duplicates, so that any male joint will engage any female joint, and therefore any edge of any pile will fit either one edge or the other of any pile.

Referring to the drawings, which accompany the specification, to aid the description, Figure 1 is an end view of the preferred form of pile, which I term a "double-arch spring-interlocking sheet-pile;" and Figs. 3 and 4 are similar views of modifications designed for more economical use where less rigidity is required, Fig. 2 being a perspective view of the curved outside piece of these piles. Fig. 5 is an enlarged detail illustrating the male and female members of the joints of Fig. 1, and Fig. 6 is an enlarged detail of the male and female members of the joints of Fig. 3. Fig. 7 is a perspective view of a complete pile similar to Fig. 1.

In Fig. 1 the three principal pieces are comparatively long and thin plates or sheets fastened together to make a hollow unit with a central diaphragm and interlocking edges. The two curved outside pieces 1 and 1 are fastened near each edge to the straight inner piece 2, so that the latter acts as a tension member to prevent their edges from spreading under pressure applied to their convex surfaces, and thus forms of each of them a complete arch with balanced reactions. This section can therefore endure great uniform external pressure and has great strength as a beam. At one edge the curved plates are separated by fillers 3 3, so that their projecting portions inclose a substantially triangular space, forming the female part of the joint, which is adapted to receive the male joint formed by the divergent edges of the other side of the plate, which are riveted together and to the center plate without fillers, as seen in Fig. 5. It is evident that this construction provides a very stiff unit, even with thin sheets of metal, and that the joints are formed with little work or expense in addition to that necessary to fasten the three principal pieces 1 1 and 2 together. The exterior surface of the male joint 5 may be made slightly smaller than the interior surface of female joint 4, so as to enter it with clearness; but I prefer to make it usually with nearly or quite the same dimensions, so that normally it cannot quite enter, but that some or all of the component pieces of the two joints must be distorted or deflected from their original position when the male enters the female part, thus utilizing the spring of the metal in holding the parts in close contact and in promoting water-tight closure of the joint.

Fig. 2 is, as above stated, a perspective view of one of the curved pieces 1 1. (Shown in Figs. 1, 3, and 4.)

Fig. 3 shows the pile modified by the omission of one of the curved pieces and having one filler 3. It is of single-arch construction and can be made lighter and cheaper than the double arch. Under certain conditions this form will be satisfactory and efficient; but it is not so well adapted to sustain pressure or impact on both sides as is that form shown in Fig. 1. The principle and operation of the male and female joints 6 and 7 is essentially the same as of the joints 4 and 5 in Fig. 1. The separator or filler 3 is similar to the fillers 3 3 in Fig. 1.

Fig. 4 shows a modification of the pile shown in Fig. 1, made by the omission of the straight plate forming the center diaphragm. This type of pile lacks the tension connection between the edges, and so does not inherently provide fully for the arch reactions. These may, however, be provided for under certain

conditions by resistance of adjacent piles or other members of the structure. This type is advantageous on account of the economy of weight and because in some conditions it may be driven more easily than the other two types.

In all three types separators may be introduced in the center of the pile transverse to the flat piece 2 to stiffen the outer walls of the pile; but these will not generally be necessary in ordinary services. In Figs. 1 and 3 the continuous flat plate 2 may be replaced by any system of tension members, like belts, straps, rods, &c., which tie the edges of the convex plate together at suitable intervals. The upper and lower ends of plates 1 1 and 2 may be reinforced by narrow plates, riveted or otherwise fastened to them, or may be extended by separate pieces of thicker and heavier plates, so as to form stronger or more massive pieces for driving-pieces or for cutting edges. The plates 1 1 may be formed in any suitable regular or irregular curves or may be made with angular bends. The joint may be formed in the outer plates, as shown, or may be made of separate pieces attached to the plates, or any suitable form of joint may be used. The contacting surfaces of both joints may be greased before the piles are driven to promote ease of driving, and the lower end of the female joint may be closed to prevent the entrance of earth, stones, &c. These piles are adapted to be driven either by impact or by jetting, or by both combined, or by other methods.

I do not limit my invention to the exact form of cross-section here shown nor limit its use to sheet-piles. I include any hollow structural member made to resist pressure, impact, or flexure which is made with two or more plates or sheets forming exterior surfaces one or both of which are curved or bent to resist pressure from the outside or to increase the stiffness of the member and has parallel longitudinal edges provided with interlocking joints. I especially include any form of such construction wherein one or two curved or bent exterior plates have their edges secured to a flat tie-plate or other tension or members, so as to prevent their separation, thus enabling the curved or bent plate or plates to act as arches, with the thrust balanced. I particularly include a pile or other structural member or hollow unit made with only two sheets, one or both of which is curved or bent or made with the outer surface composed of two sheets only and having a flat interior plate or diaphragm connecting the other plates, so as to tend to prevent their deformation, relative displacement, or distortion. I also include hollow units, as above described, whether used for piles or for any other permanent or temporary structural or constructional purpose or operation.

Having described my improvements, I claim as my invention—

1. A hollow sheet-pile unit having one or more convex surfaces and a flat interior plate or diaphragm adapted to act as a chord of the curved surface, substantially as described.

2. A hollow sheet-pile unit provided with one convex and one flat surface, substantially as described.

3. A hollow sheet-pile unit provided with two exterior bent or curved plates and a flat interior plate or diaphragm, substantially as described.

4. An interlocking joint provided with a female part consisting of converging plates and a filler fastened to the closed edge, substantially as described.

5. A hollow sheet-pile unit provided with a flat plate fastened directly to the convex side of a bent or curved plate near one edge and fastened indirectly thereto near the other edge through a separating filler-piece, substantially as described.

6. The combination of a pile composed of a plurality of plates, integral extensions on one edge of said plates forming converging members of a female joint, and integral extensions on the other edge of said plates forming diverging members of a corresponding member of a male joint, substantially as described.

Signed at New York city this 12th day of January, 1906.

FRANK W. SKINNER.

Witnesses:

HENRY V. BROWN,

WALTER N. HARRIS.