Sept. 3, 1946. R. F. McMAHAN 2,407,090

METHOD OF APPLYING METAL BINDING-STRAPS

Original Filed Oct. 15, 1938 7 Sheets-Sheet 1

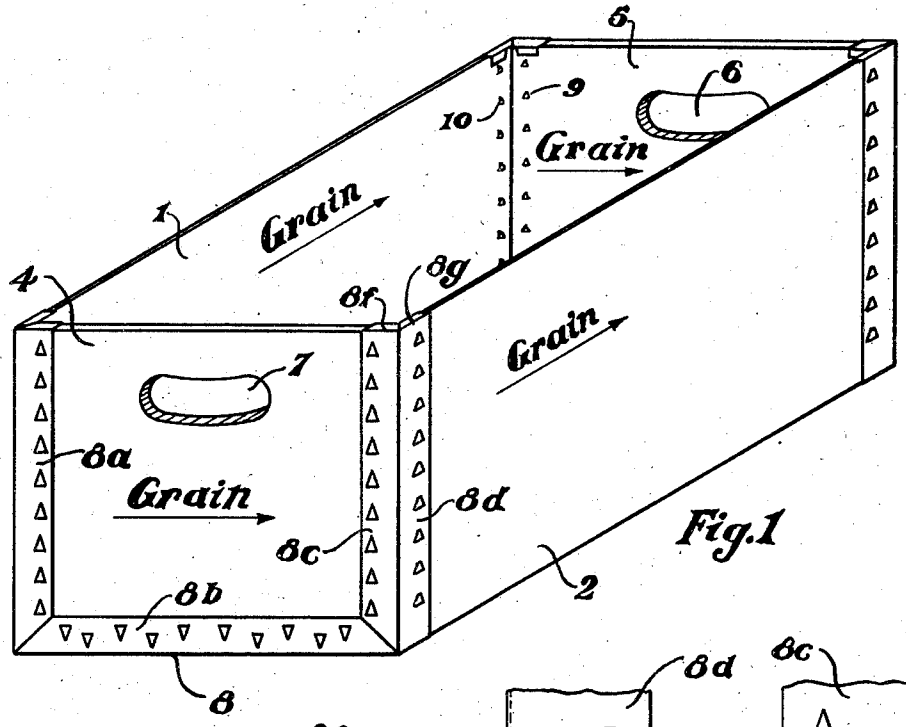


Fig.1

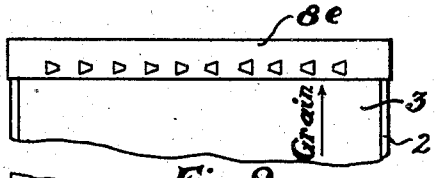


Fig.2

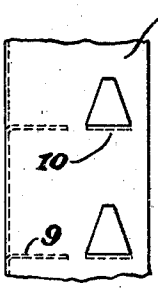


Fig.5

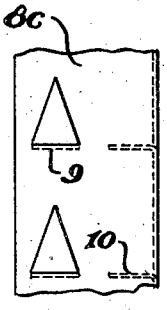


Fig.6

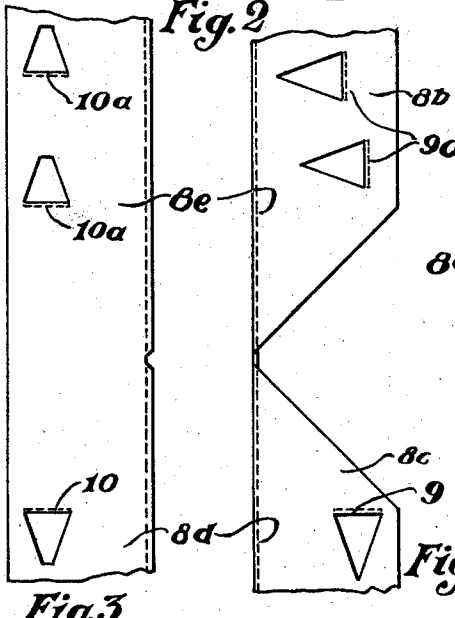


Fig.3

Fig.4

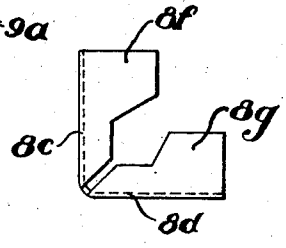


Fig.7

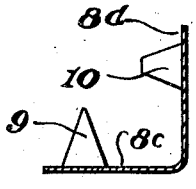


Fig.8

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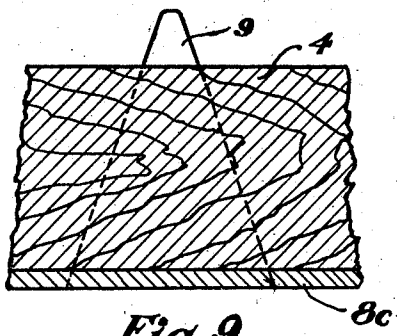


Fig. 9

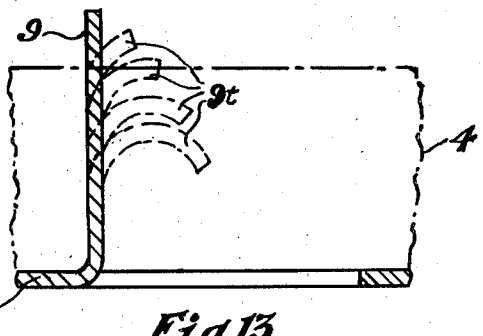


Fig 13

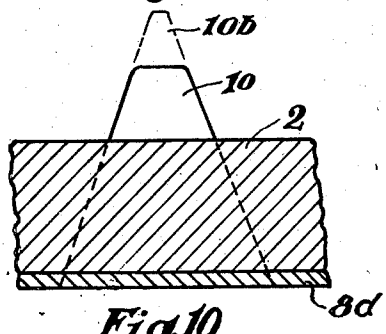


Fig.10

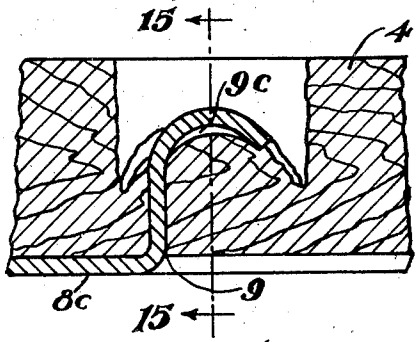


Fig.14

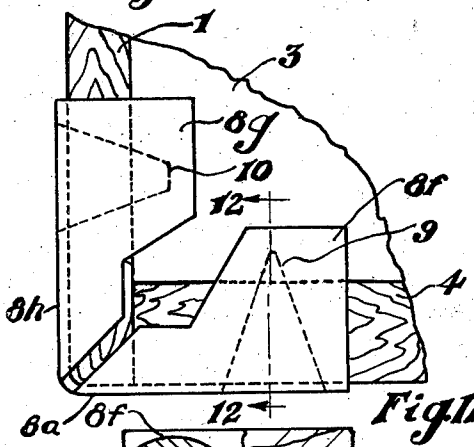


Fig.11

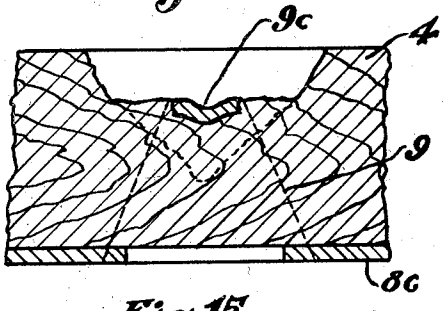


Fig.15

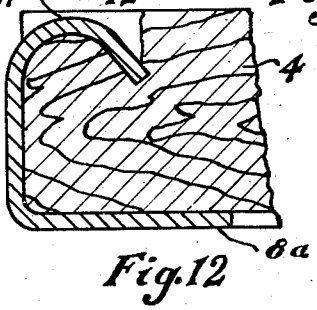


Fig.12

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METHOD OF APPLYING METAL BINDING-STRAPS

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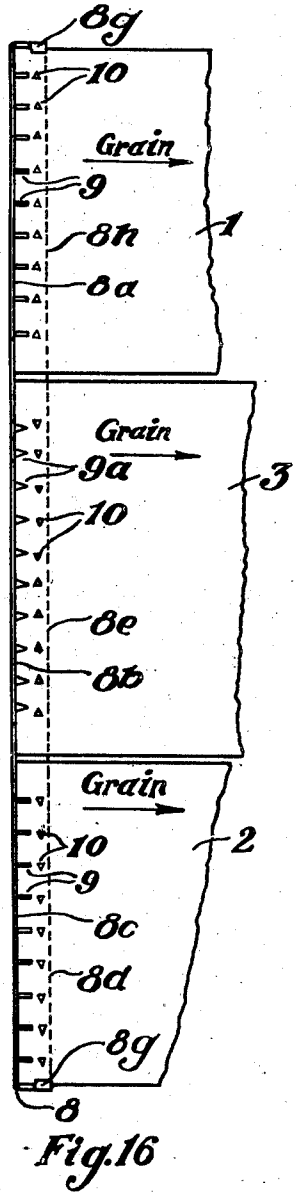


Fig. 16

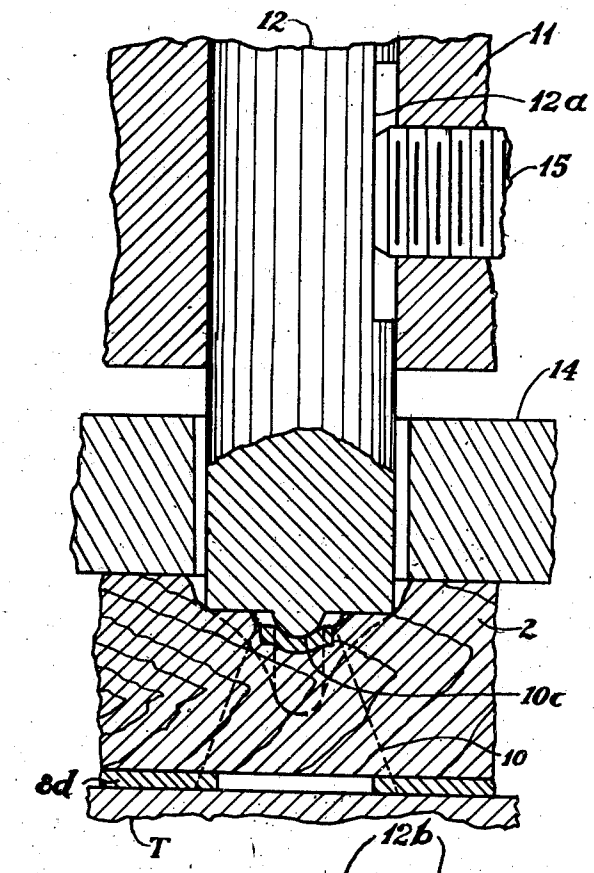


Fig. 25

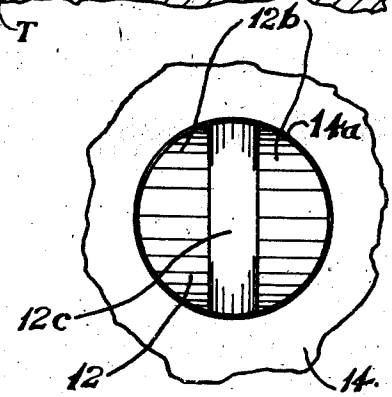


Fig. 26

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METHOD OF APPLYING METAL BINDING-STRAPS

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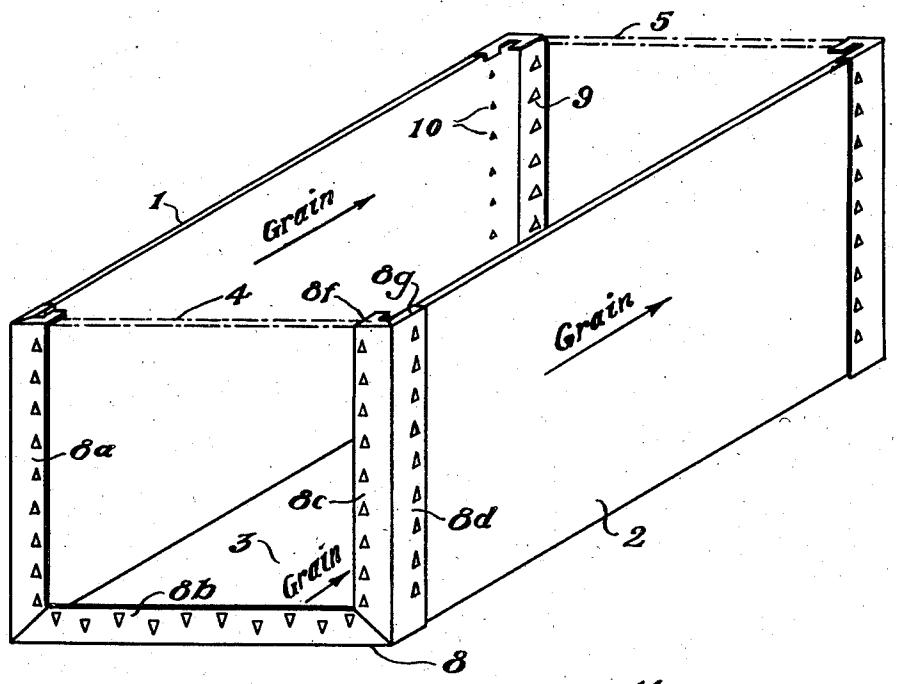


Fig. 17

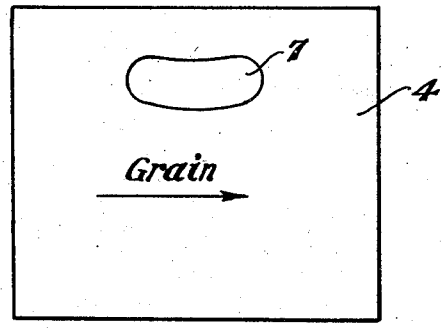


Fig. 18

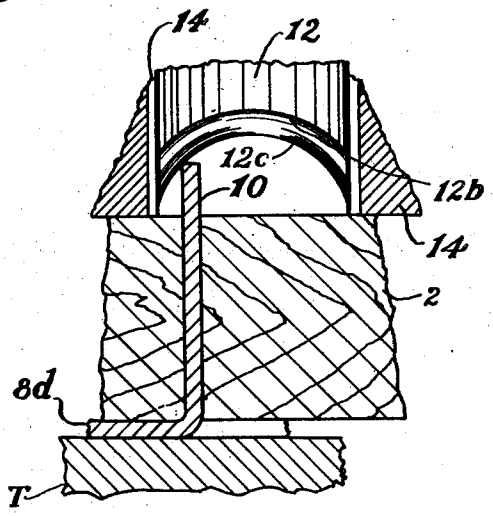


Fig. 24

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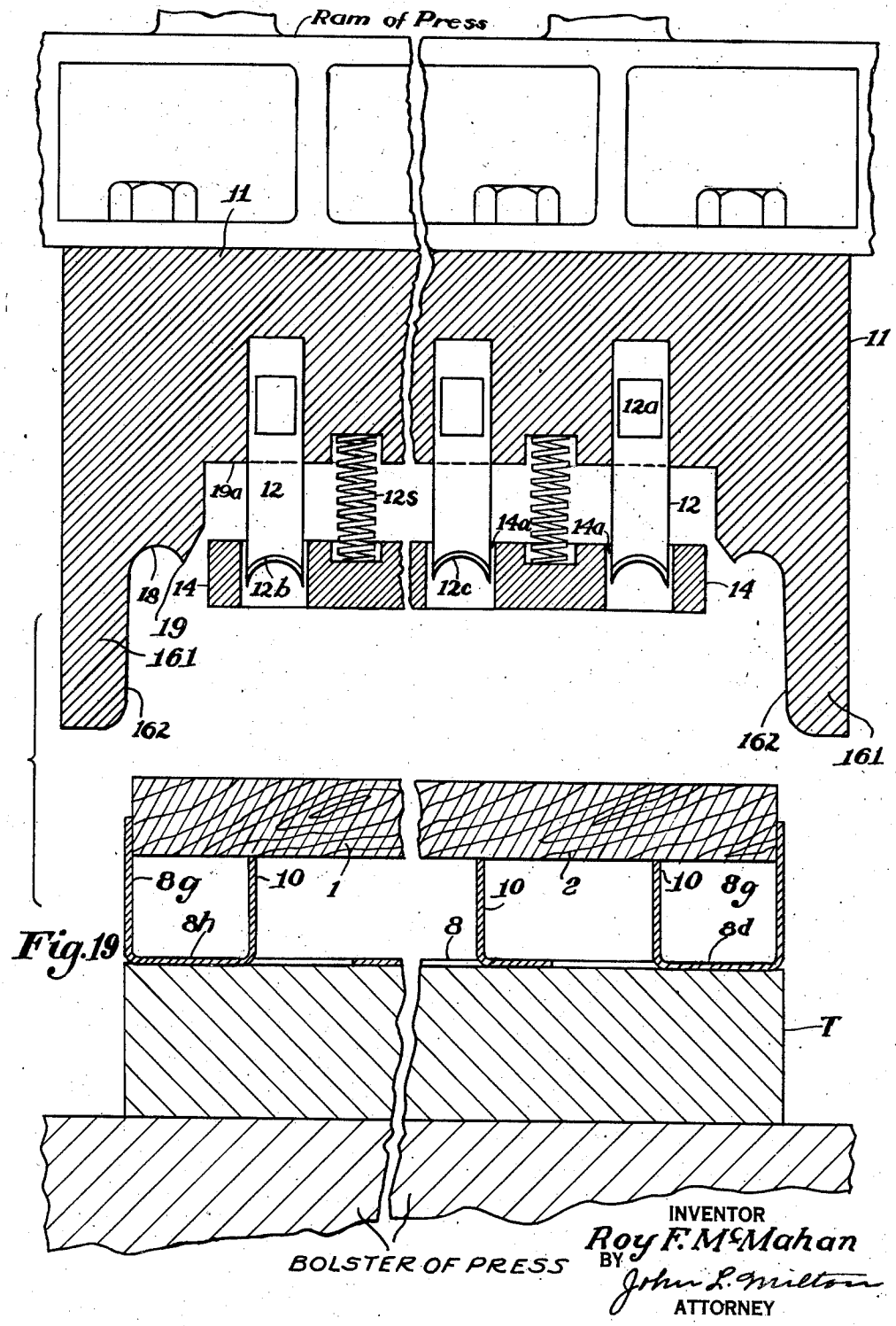


Fig. 19

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METHOD OF APPLYING METAL BINDING-STRAPS

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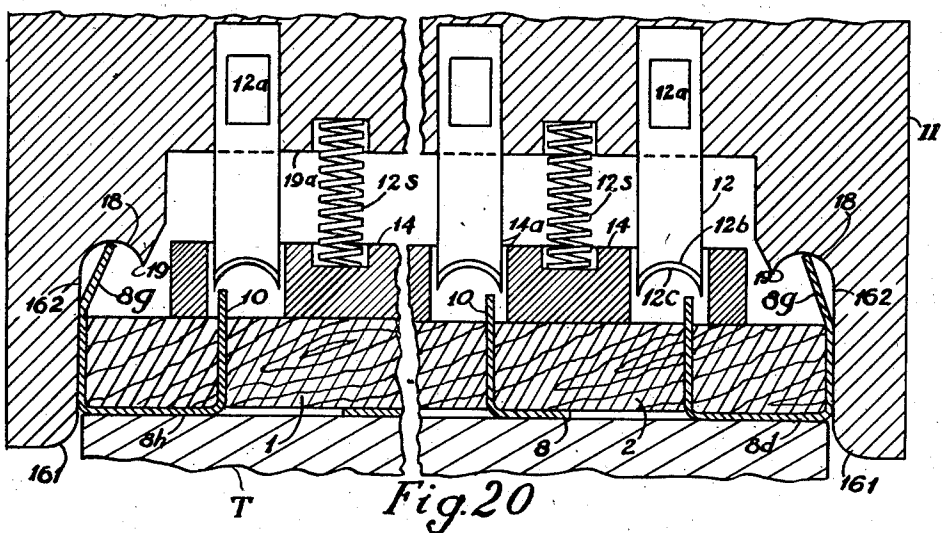


Fig. 20

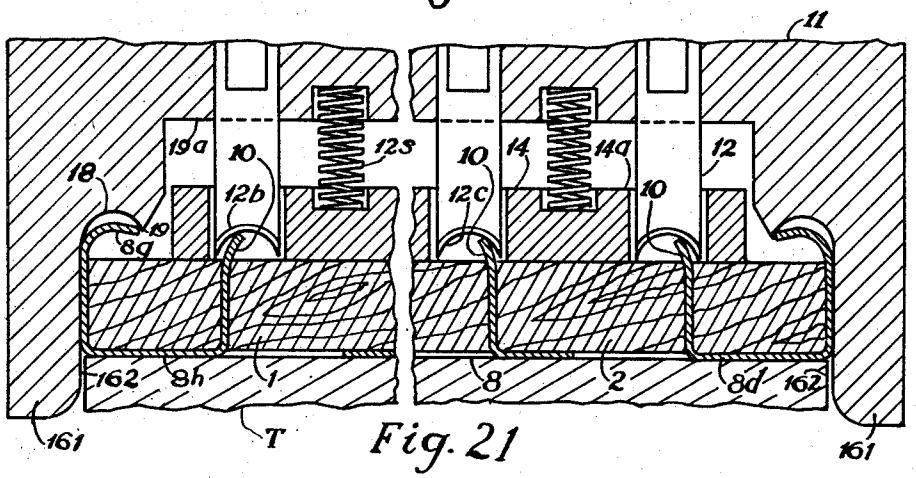


Fig. 21

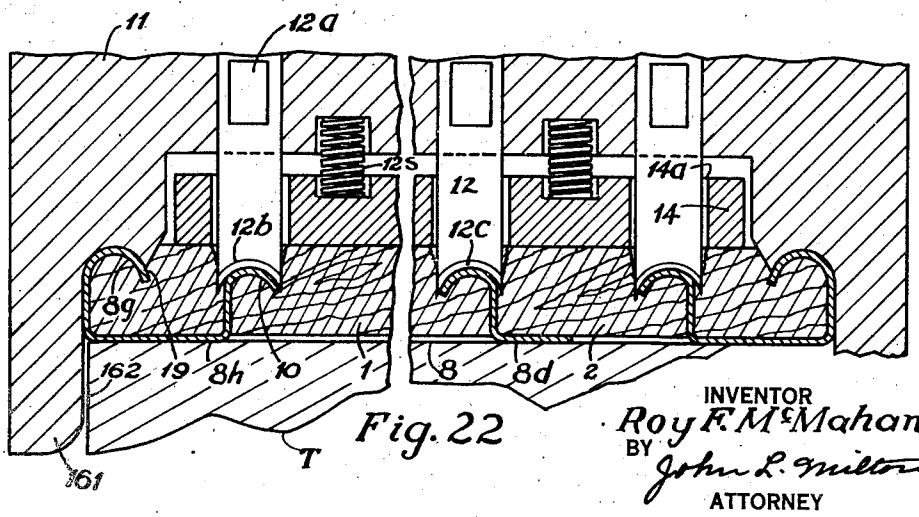


Fig. 22

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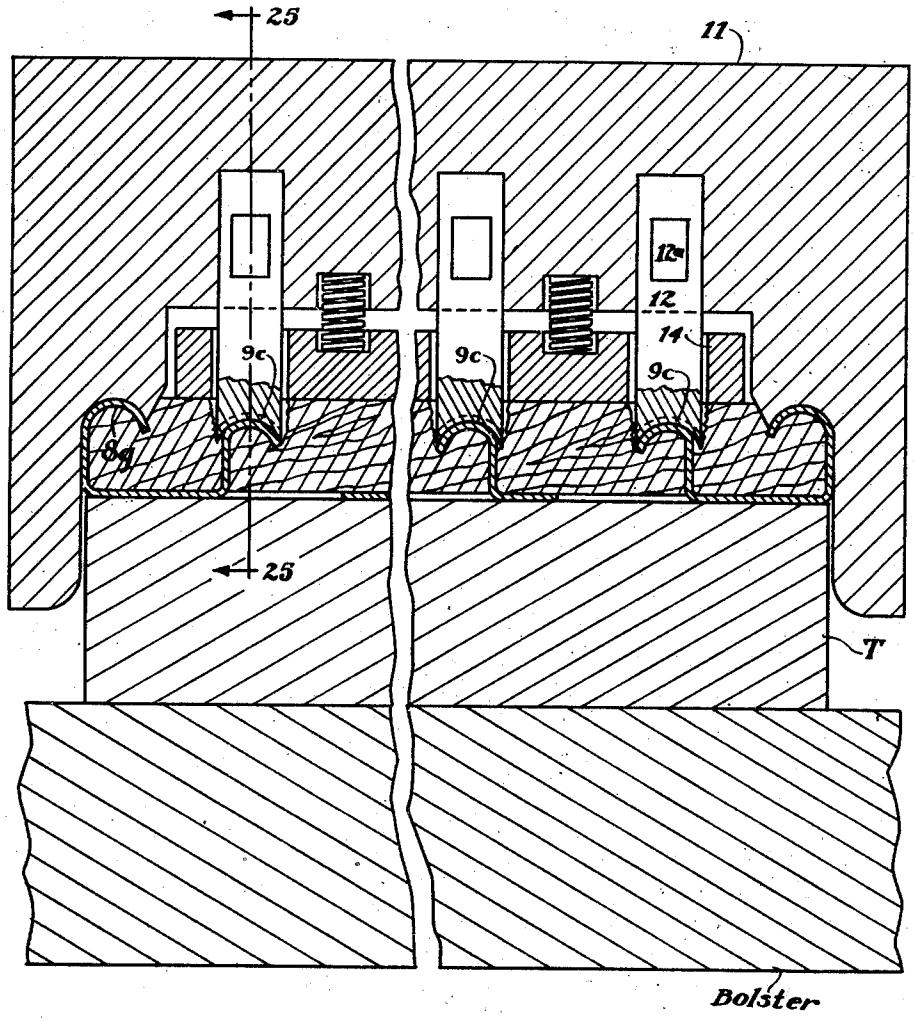


Fig. 23
(end of stroke)

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Patented Sept. 3, 1946

2,407,090

UNITED STATES PATENT OFFICE

2,407,090

METHOD OF APPLYING METAL BINDING-STRAPS

Roy F. McMahan, Arlington Road, near Louisville, Ky.

Original application October 15, 1938, Serial No. 235,129. Divided and this application January 30, 1943, Serial No. 474,207

5 Claims. (Cl. 1—11)

1

The present invention relates to improvements in the method of applying metal binding-straps, and is a division of my earlier application, Serial No. 235,129, filed October 15, 1938, issued as U. S. Letters Patent No. 2,309,655, on Feb. 2, 1943, and entitled "Metal bound box."

In the aforesaid application there is disclosed a wood box having a metal binding-strap engaging one face of each of the respective box sections. The strap is provided with a plurality of teeth, struck therefrom and integral therewith, and each tooth has a relatively flat shank extending through its respective box section. The free-end portion of each tooth is folded against the opposite face of the respective box section, and is arched longitudinally throughout the length thereof so that the end edge of the tooth is curled into the respective box section. Each tooth has a concave corrugation extending transversely throughout the arch free-end thereof, for securing the same in its folded position against the opposite face of the respective box section. Therefore, the primary object of this invention to provide an improved method of folding the free-end of each tooth, curling the same, and substantially simultaneously therewith, forming the re-enforcing corrugation transversely throughout the arched free-end of each tooth.

Another object of this invention is to provide a method that will be equally useful in applying metal-straps to articles other than the wood box illustrated in this application.

A further object of this invention is to provide a method of making metal-bound boxes that will permit such boxes to be made from relatively thin and inexpensive material, and to be expeditiously manufactured at low cost.

A still further object of this invention is to provide a method of making boxes that will permit the assemblage of the side and bottom portions to be effected with a single stroke of a conventional power-press, and likewise the respective end portions of the box.

These and other objects of the invention will be manifested to those skilled in the art as the following description is read in connection with the accompanying drawings, in which:

Figure 1 is a perspective view of a box constructed in accordance with the teachings of this invention;

Figure 2 is a partial view of one end of the box as viewed from the bottom;

Figure 3 is a partial view showing one outer face of the metal binding-strap;

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Figure 4 is a partial view showing the other outer face of the metal binding-strap;

Figure 5 is a partial view showing the outer face of the metal binding-strap that lies along side 2 of the box;

Figure 6 is a partial view showing the outer face of the binding-strap that lies along end 4 of the box;

Figure 7 is an end view of the metal binding-strap showing the corner protecting members 8*f* and 8*g* before the same are secured to the corresponding side and end of the box;

Figure 8 is a partial sectional view of the binding-strap showing the construction and relation of the short teeth 10 that are pressed through the relatively-thin-side members of the box, and long teeth 9 that are pressed through the relatively-thick end-members of the box;

Figure 9 is an enlarged partial sectional view of the binding-strap illustrating a long tooth 9 pressed through end-member 4 of the box, but not secured thereto;

Figure 10 is an enlarged partial sectional view of the binding-strap illustrating a short tooth 10 pressed through the side member 2 of the box, but not secured thereto;

Figure 11 is an enlarged partial view of the corner of the box illustrating teeth 9 and 10 pressed through their corresponding box-members, and also showing the relation of the corner protecting members 8*f* and 8*g* before being secured to the corresponding box members;

Figure 12 is a partial sectional view taken along lines 12—12 of Figure 11 showing the shape of the corner protecting member 8*f* after same is secured to its corresponding box member;

Figure 13 is a partial sectional view illustrating in dot-dash lines 9*t*, the relative progressive steps through which a tooth 9 is moved and formed to secure same to a box member;

Figure 14 is a partial sectional view illustrating the final shape of a tooth 9 in secured relation with its corresponding box member;

Figure 15 is a partial sectional view taken along lines 15—15 of Figure 14 showing a re-enforcing bead formed in a tooth 9, when the tooth is moved into secured position with a box member;

Figure 16 is a partial plan view illustrating the assemblage of the sides and bottom members of the box in flat form prior to being folded up into the form illustrated in Figure 17;

Figure 17 is a perspective view illustrating the sides and bottom of the box secured to the binding straps and folded into position for receiving

and securing the end members 4 and 5 of the box;

Figure 18 is an elevational view of the end member 4 of the box prior to its assemblage with the box;

Figure 19 is a partial vertical sectional-view illustrating the strap applying apparatus in normal condition, that is, the relation of the various parts after the press is loaded and before the press is operated;

Figure 20 is also a partial sectional view illustrating the strap applying apparatus substantially completing the operation of pressing the teeth 10 through the box members, it being understood that bottom member 3 lies between the members 1 and 2 as illustrated in Figure 16;

Figure 21 is also a partial vertical sectional view illustrating the strap-applying apparatus substantially beginning the step of bending the teeth 10 and corner protecting members 8g into approximately arch-shape;

Figure 22 is likewise a partial vertical sectional-view illustrating the strap-applying apparatus substantially completing the arch forming operation required to curl the free-end edges of each end protecting member 8g into their respective box sections, and substantially beginning the forming of the reenforcing bead 9c, as illustrated in Figs. 14, 15 and 25, in the arched free-end portion of each tooth;

Figure 23 is also a partial vertical sectional-view illustrating the strap-applying apparatus substantially completing the forming of the reenforcing bead 9c in the arched free-end portion of each tooth;

Figure 24 is an enlarged partial elevational view of one of the tooth forming tools, which illustrates the tooth 10 pressed into and through box member 4 by pressure plate 14, with the tooth forming tool 12 progressed into position for beginning the forming operation of the tooth;

Figure 25 is an enlarged partial sectional-view taken along lines 25—25 of Figure 23;

Figure 26 is an enlarged bottom view of one of the forming tools 12.

With reference to Figure 1, it will be observed that the box is preferably constructed from five pieces of relatively thin wood, or similar material, to form the side members 1 and 2, end members 4 and 5, and bottom member 3. It will also be observed that all of the box members are rigidly and permanently secured together by two metal binding-straps 8 of specially constructed angle section.

Each face of the angled binding-straps has a series of teeth struck therefrom, which teeth are adapted to be pressed into and through juxtapositioned faces of the box members, in a manner hereinafter described, for rigidly and permanently securing the same together without the use of nails, screws, battens, or other independent securing means.

With particular reference to Figures 1 to 17, inclusive, it will be observed that the teeth along each face of each binding strap have a triangular shape and project substantially at right angles to the corresponding face thereof and in substantially a flat plane. In this respect particular emphasis is made of the fact that the plane of each tooth is formed to register with the grain of the wood forming the respective side, end and bottom member of the box. This construction is clearly illustrated in Figures 1, 2, 16 and 17. The object of this construction is not only to facilitate assemblage, but to provide the least possible fracturing of the fibres of the wood so as to afford the

greatest mechanical strength. This construction further minimizes rejects because of split wood members that would otherwise be encountered by not having the plane of the teeth substantially parallel with the grain of the wood. This construction further enables the teeth to be pressed into and through the box members with the least possible disturbance to their free projecting positions, thus assuring proper alignment of the teeth with their corresponding forming or clinching tools, hereinafter described.

In arranging the box members prior to being assembled in the form illustrated in Figure 1, two specially-constructed angled binding-straps of the required length and gage are provided, each strap having a series of teeth struck from each of its faces and substantially uniformly spaced throughout its length. The particular relation of each tooth one to the other and to the grain of the wood forming the box members is clearly illustrated in Figure 1.

In assembling the binding straps with the box members, the two straps are laid parallel on a table T which table is fixedly secured to the stationary bolster plate of a conventional power press, frequently referred to as a "punch press." Each strap is placed upon the table T, and the sides 1, 2 and bottom 3 laid flat-wise upon the free end-edges of the teeth on the corresponding faces of the binding straps, as illustrated in Figure 19. With the use of suitable tools, such as illustrated in Figures 19 to 26, inclusive, the aforesaid box members are pressed downwardly so that the upstanding teeth 10 are pressed into and through the box members. Observe Figures 19 to 25, inclusive. Each side member 1 and 2 and the bottom member 3 are spaced, and the upright face of each strap is formed with a V gap or mitre adjacent each junction of a side and bottom member, so that the box members can be subsequently folded to assume the position illustrated in Figure 17.

Referring now to Figures 19 to 26, inclusive, it will be observed that the apparatus for pressing the teeth 10 into and through the box members, subsequently clinching same, and substantially simultaneously therewith forming the reenforcing bead 9c in the arched free-end of each tooth, comprises a series of similar forming tools 12 carried by a die block 11, and a pressure plate 14, normally biased away from the die block 11 and in the position illustrated in Figure 19 by suitable springs or rubber blocks disposed between the die block 11 and pressure plate 14.

Thus, it is to be understood that the pressure plate 14 is provided with conventional guide pins and conventional limit stops, so that the same is normally held in the position relative to the forming tools 12 shown in Figure 19. Obviously, such expedients are well known to those skilled in the art, and it is not necessary to elaborate upon their construction and relation. Likewise, the conventional reciprocating power press, ordinarily referred to as a "punch press" is not shown in the drawings as the construction of such a press is also well known and understood by those skilled in the art. Therefore, it is to be understood that the construction and arrangement of the guide pins and limit stops for the pressure plate 14, also the mounting of the die block 11 and table T upon a power press may take various forms without departing from the spirit of this invention, inasmuch as the essential novelty of this invention resides in the method of attaching

or securing the metal binding-strap to the wood members of the box.

In the drawings, only vertical sectional-views of the forming tools are presented, as it is believed that these are the essential views required to gain a thorough understanding of the various steps by which the binding straps and box members are secured together. Thus, it is to be understood that the tool holder or die block 11 is provided with suitable means for mounting the same upon the reciprocating slide of a conventional power-driven punch-press, for vertically reciprocating the same relative to the stationary anvil or table T, which table is fixedly secured to the stationary bolster plate of the press. Accordingly, as indicated in Figures 19 to 26, inclusive, it is to be understood that the metal binding-strap 8 rests upon the anvil or table T, while the reciprocating forming tool consisting of pressure plate 14 and forming tools 12, etc., is moved downwardly into engagement with the respective box members and the teeth of the binding strap.

The specific apparatus illustrated in the drawings is primarily employed to secure metal binding-straps to the side and bottom members of a box. Therefore, it is to be understood that the shape and size of the anvil T, likewise the shape and size of the pressure plate 14 and forming tools 12, 18, etc., may be altered to accommodate the particular shape and size and any other type of strap or member, where it is desired to practice the teachings of this invention in securing the same together. Accordingly, it is important to observe the relation existing between the inner faces of the arched ends of the forming tools 12, and the outer faces of the teeth that are engaged by these tools, to understand the method employed in securing the parts together, and, for this purpose, attention is again directed to Figures 19 to 23, inclusive.

Figure 19 shows the relation of the box members 1, 2 and 3 relative to the upstanding teeth 10 of the binding strap, and the relation of the movable die 11 relative to the box members, metal strap and table T, when the press is loaded and ready to begin the assembling operation.

Figure 20 shows the relation of the various parts after the teeth have been pressed into and through the box members, and just prior to the time the clinching tools 12 engage the free ends of the respective teeth.

Similarly, Figure 21 shows the relation of the various parts immediately after the clinching tools 12 engage the respective ends of the teeth and begin the curling and bending movements upon the teeth.

Likewise, Figure 22 shows the relation of the various parts near the end of the stroke of the power press, that is the relation of the various parts substantially when the arcuate beading rib 12c on each tool 12 begins the forming of the reenforcing corrugation in the arched free-end of each tooth, and Figure 23 shows the relation of the various parts at the end of the stroke of the power press, that is, the relation of the various parts when the "curling" and "reenforcing" operation on each tooth have been completed.

Thus, it will be apparent that the pressure plate 14 first contacts the wood box members and presses the teeth 10 into and through same by force from the power press transmitted to said plate through springs 12s, which springs are sufficiently strong to cause the teeth 10 to be forced into and through the wood members before the pressure plate 14 has any appreciable movement relative to the die block or tool holder 11.

It is also to be understood that the downward movement of the tool holder 11, relative to the table T is continuous, and that Figures 20 to 23, inclusive, merely illustrate the relation of the various parts at predetermined points in the downward movement of the tool holder 11, so that the method of bending, curling, and reenforcing the teeth may be illustrated.

Figures 20 and 25, respectively, show the relation of the various parts at the beginning and at the end of the curling of a tooth 10, and particular attention is directed to the shape and construction of each forming tool 12. It will be observed that the end of each tool 12 has an arcuate beading rib 12c located centrally of the lower face of the forming tool 12. Note Figure 26.

Thus, each arcuate beading rib engages the free-end of a tooth in its downward movement and continuously and progressively rotates or curls the free end thereof in the manner illustrated in Figures 20 to 23, inclusive. In like manner it is to be understood that similar tools engage the teeth 9, and progressively rotate the same as indicated in Figure 13 until the final position illustrated in Figures 14 and 15 is reached. Therefore, it will be understood that, just prior to a tooth reaching the final curled condition, the resistance of the compressed box members increases and exerts sufficient pressure to cause a reinforcing bead to be formed in the curled end of the tooth.

From the foregoing, it will be apparent that the herein disclosed method of attaching a metallic binding-strap to the box members, comprises, simultaneously pressing the flat teeth of the strap into and through the respective box members and until a portion of the free-end of each tooth extends beyond the plane of a surface of the respective box section; then bending the extended portion of each tooth laterally and downwardly at the surface of the respective box member and into approximately arch-shape while the extended portion of each respective tooth is spaced from the said surface of the respective box member; then continuing both of the bending movements until the free-end edge of each tooth is pressed into the said surface of the respective box member during the arch forming operation; and forming a concave reenforcing bead longitudinally throughout the length of the arched free-end portion of each tooth substantially simultaneously with the pressing of the free-end edge of each respective tooth into the said surface of each respective box member.

It is important to observe that my invention contemplates a slight shearing of the fibres of the box members adjacent the inner faces thereof, so that each tooth is independently and simultaneously curled to a position below the inner face of the box members. This construction eliminates objectionable metallic projections within the box that may otherwise injure the hands of those required to handle the box.

Thus, with a single stroke of a power press, the side and bottom members of the box are secured to the corresponding faces of the binding straps, and assume the position illustrated in Figure 16, whereupon the sides are manually folded to assume the positions illustrated in Figure 17.

In Figure 17, it will be observed that each end of the binding strap is provided with corner pro-

tecting and securing members 8*g*. These members are each curled around the edge of the corresponding box member and their free ends curled into the box member. Note Figure 12 which particularly illustrates the corresponding member 8*f*. The method of effecting the securing of members 8*g* and 8*f* is embraced in my issued United States Letters Patent Number 2,201,193 issued May 21, 1940, and entitled "Method of attaching a hanger," and the tools employed to curl the end members 8*f* and 8*g* are embraced in my issued United States Letters Patent Number 2,253,639 issued August 26, 1941, and entitled "Bending die." Similarly, the tools employed in the curling and corrugation of the teeth 9 and 10 are embraced in my copending application, Serial Number 437,301 filed April 1, 1942, and entitled "Apparatus for applying metal straps."

As mentioned hereinbefore, the side members 1 and 2 are folded upright, as illustrated in Figure 17, after the side and bottom members are secured to the binding straps. Then the end members 4 and 5 are placed within the partially completed box, either separately or together, so that when the required pressure is exerted against each end member, the teeth 9 are pressed into and through the respective end members and subsequently curled in the manner outlined for the teeth 10, thus rigidly securing the end members to the binding-straps and producing the completed box illustrated in Figure 1. It will be observed that the end protecting members 8*f* of the binding straps are also simultaneously curled around the upper edges of the respective end members and curled therein, as shown in Figure 12, and hereinbefore described in connection with members 8*g*.

In Figure 25 it will be observed that each forming tool 12 has a flat portion 12*a* and is secured to the tool holder 11 by means of set screws 15.

From the foregoing it will be apparent that I have provided an extremely effective and durable method of permanently securing the side, bottom and end members to metallic binding-straps. This method must not be confused with conventional bending or riveting operations, which methods do not assure a solid and permanent connection. In this respect particular emphasis is made of the fact that my method of securing assures that the box members are solidly and rigidly secured to the binding straps. Obviously, variations in the thickness of the box members are to be expected, but because of the method of curling the teeth 9 and 10 into the box members, and the reinforcing of each curled tooth, the same positive securing action is provided, even when wide variations are encountered. Further, my curling action is distinct from the conventional riveting operation, in that the upright portion of the tooth passing through the box member retains a taut condition as the free end is curled and pressed into and through the respective box member. Obviously, in riveting, the upright portion between the bent free end and the base is likewise irregularly bent, which irregular bending renders it practically impossible to effect a permanent and rigid construction. It is of equal importance to observe that the small diameter forming tool 12 in shearing the fibres of the inner face of the box member adjacent the clinched tooth and binding strap contributes materially to the solid construction of my box.

In summary it is pointed out that the making of a box according to the teachings of my invention consists of providing suitable end, side and bottom members, which members require no special pre-cutting, forming or jointing. With these members at hand, angled binding straps are formed as illustrated in the annexed drawings, each strap having a plurality of teeth struck from each face in a manner so that each tooth will penetrate its corresponding box member substantially parallel with the grain of the material forming the members.

While the binding straps are in their horizontally extended positions the sides and bottom members are secured thereto by pressing the teeth of the straps into and through the box members and then progressively and simultaneously curling each tooth into clinching relation with its corresponding box member; then folding the sides into an upright position, and securing each end member to its co-related or corresponding binding strap in the same manner in which the sides, etc., are secured thereto by means of a separate set of instrumentalities on the same principle, thus producing a finished box having a durable and solid construction.

It is important to observe that the teeth struck from each face of the binding straps are comparatively close together, and that they are formed away from the horizontal edges of the binding straps. This construction is important, as it assures the holding down of both horizontal edges of each strap tightly against the box, therefore preventing these straps from catching on other boxes. The forming of the teeth away from the horizontal edge also contributes to this important consideration, as this leaves each horizontal edge smooth and free from serrated edges that are otherwise provided when the teeth or fastening pieces are struck from the metal along the horizontal edges.

Having thus described my invention, I claim:

1. The method of securing a metal binding-strap, having a plurality of integral projections struck therefrom, to a wooden wall member of a box, which consists in pressing said projections through the wall member until one face of the wall member flatly contacts the adjacent face of the strap and the free end portion of each projection extends beyond the opposite face of the wall member, continuously curling the free end portion of each projection a substantial amount into the said opposite face of the wall member and until the entire end portion of each projection is arch-shaped and the outer face of the arch-shaped portion lies below the plane of the said opposite face, and forming a corrugation in the arch shaped portion of each projection to give added strength and securing ability.

2. The method of securing to sections of a wooden box a metal binding-strap having a plurality of integral, fastening projections struck therefrom, which consists in placing the free-end edges of the projections in engagement with one face of the respective box sections and then forcing the projections through said sections until a portion of each projection extends beyond the opposite face of its respective section, curling the extended portion of each projection into arch-shape and forcing each arch-shaped portion into and below the surface of said opposite face, and forcing of the longitudinal central portion of the arch-shaped portion of each projection further below the surface of the opposite face of its respective section to form an arcuate reenforcing rib longitudinally along the

arched portion of each projection to give added strength and securing ability.

3. The method of securing to a wooden member a metal member having a bendable, integral, fastening projection struck therefrom, the length of the projection being greater than the thickness of the wooden member, which consists in placing the free end of the projection against one face of the wooden member, forcing the projection through the wooden member until one face of the latter contacts the metal member and the free end portion of the projection extends beyond the opposite face of the wooden member, continuously curling the free end portion of the projection into arch-shape and forcing the arch-shaped portion into the wooden member so that the outer face of the curled end is below the surface of said opposite face, and forming a concave corrugation longitudinally along the arch-shaped portion of the projection to give added strength and securing ability.

4. The method of securing to sections of a wood box a metal binding-strip having a plurality of bendable, integral, fastening projections struck therefrom, which consists in placing the free-end edges of the projections in engagement with one face of the respective box sections and then forcing the projections through said sections until one face of the latter contacts the metal strip and the free end portion of each projection extends beyond the opposite face of its

respective section, bending the extended portion of each projection laterally and downwardly over the opposite face of its respective section into approximately arch-shape and forcing the same into the wood of the respective section and below the surface of said opposite face thereof, and forming a concave corrugation longitudinally in the arched portion of each projection, the compression of the wood when forcing each respective arched portion thereinto facilitating the formation of the concave corrugation.

5. The method of securing to sections of a wood box a metal binding-strip having a plurality of bendable, integral, fastening projections struck therefrom, which consists in placing the free-end edge portions of the projections in engagement with one face of the respective box sections, forcing the projections through the respective box sections, bending said free-end portions against and forcing them into and below the adjacent face of the box section and while so doing continuously curling the free-end portions into arch-shape longitudinally throughout the length thereof, and substantially simultaneously therewith forming in each of the arched portions a longitudinal concave corrugation, the wood of the box sections just prior to each arched portion reaching its final compression faciltating the formation of the said concave corrugation.

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