April 30, 1946. F. HOBBS 2,399,348

BENDING MECHANISM

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FIG_1

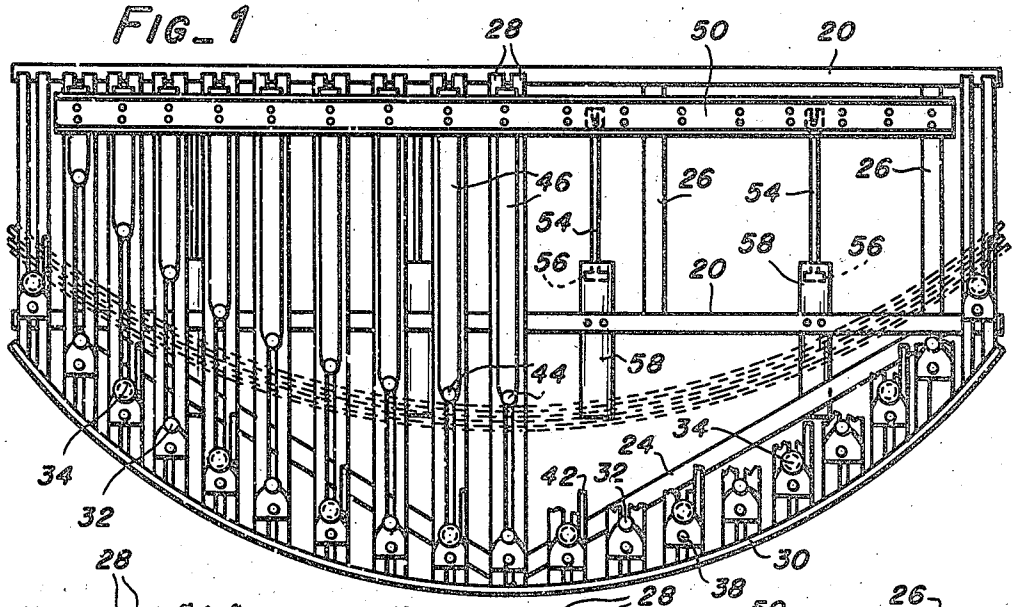
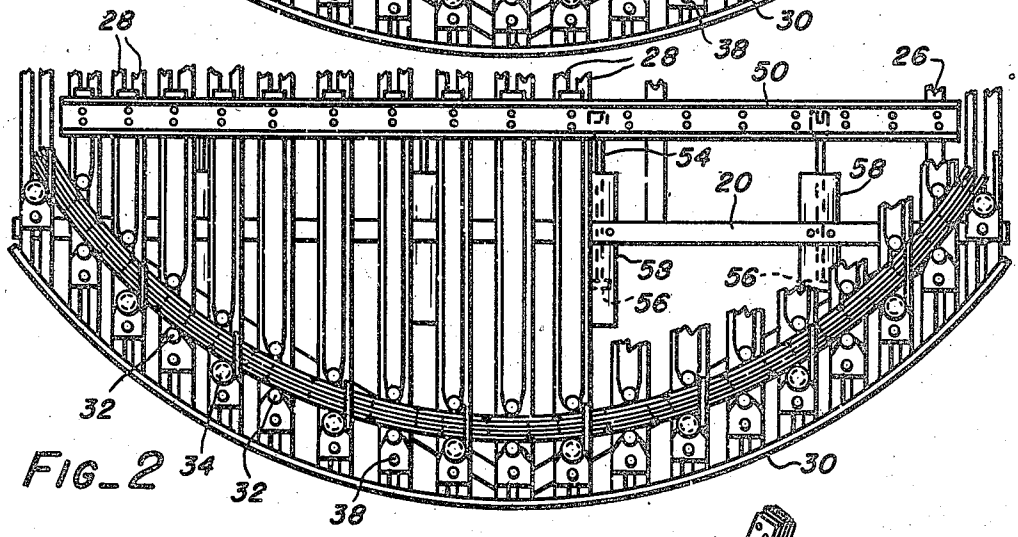


FIG_2



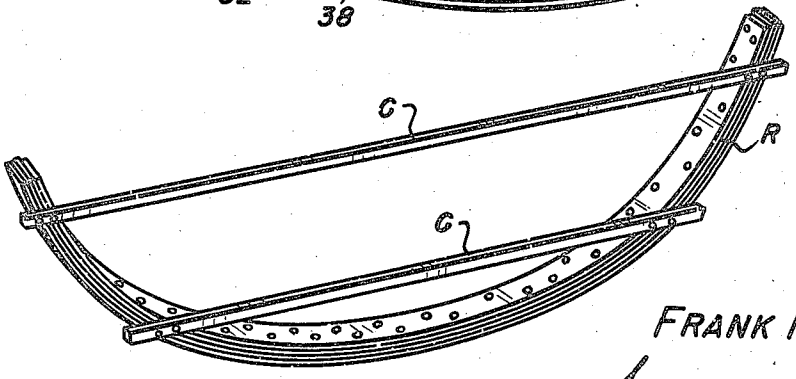


FIG_12

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BENDING MECHANISM

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FIG_3

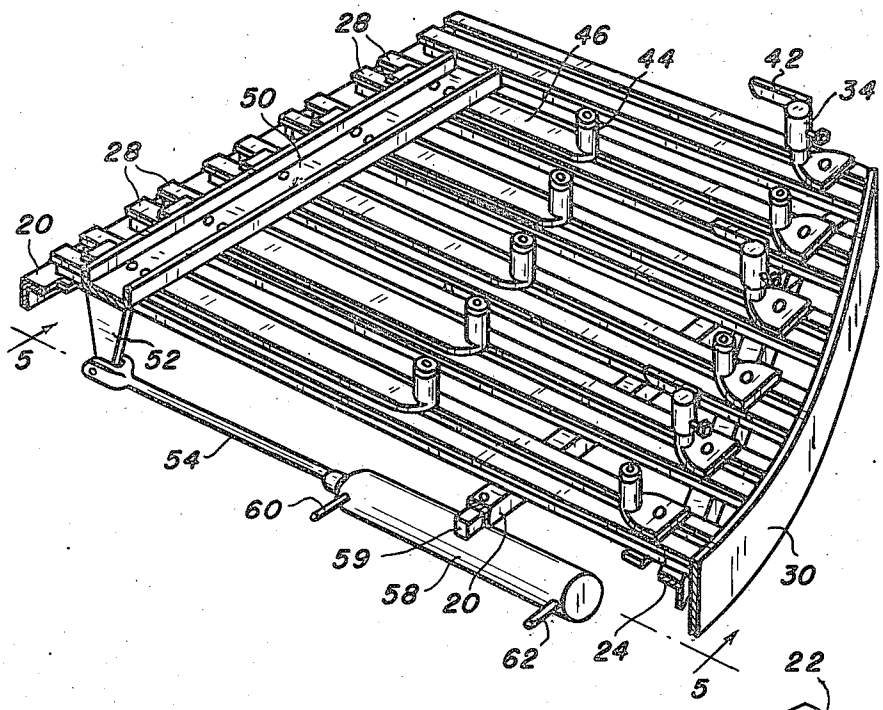
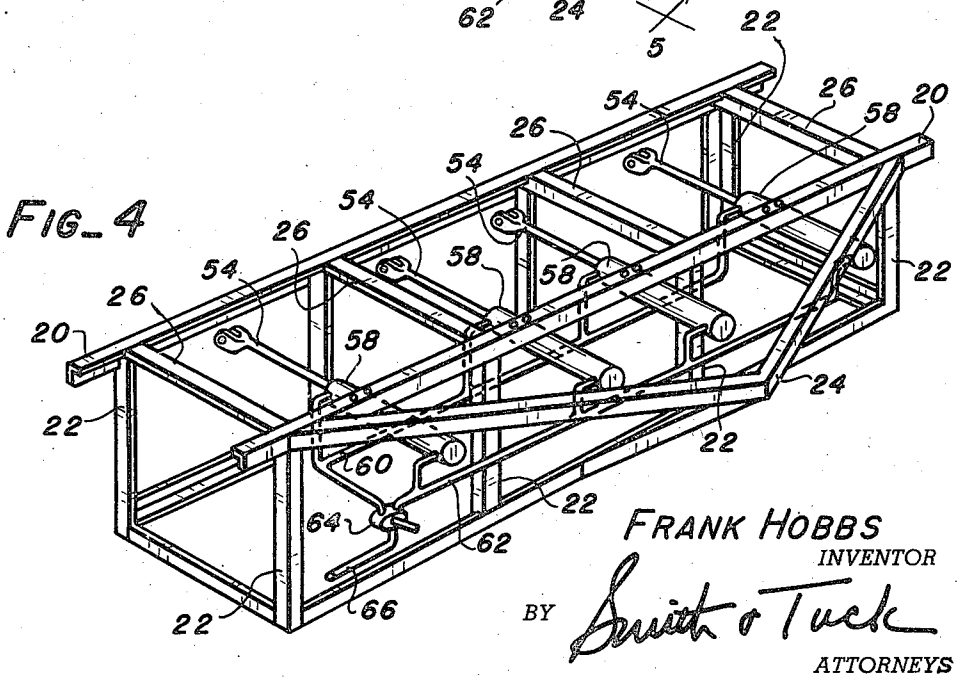


FIG_4



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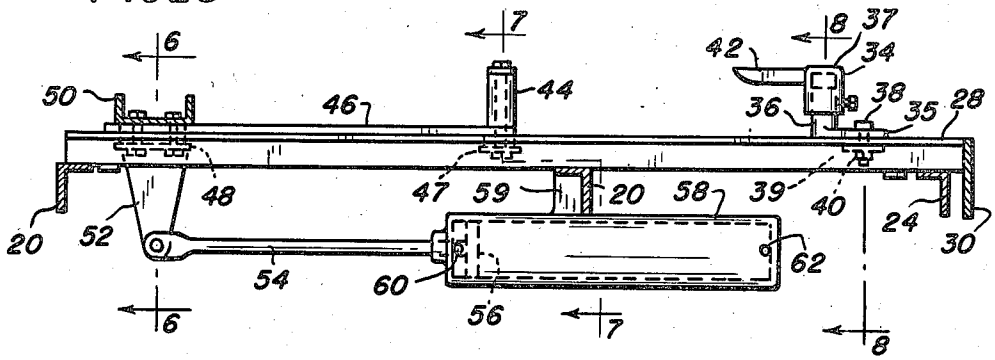
BY Smith & Tuck
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BENDING MECHANISM

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FIG_5



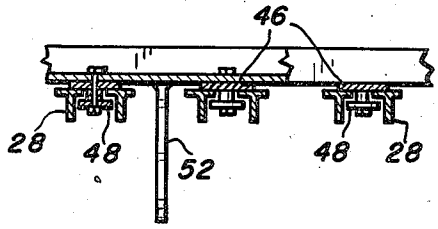


FIG_6

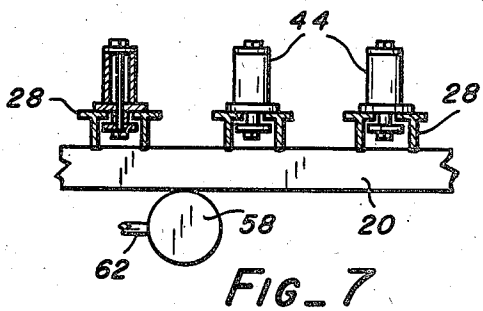


FIG_7

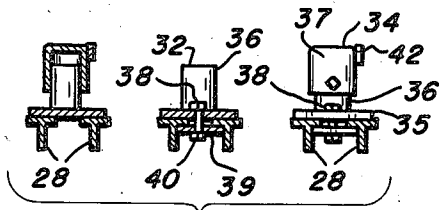


FIG_8

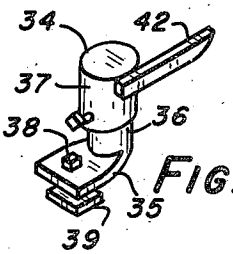


FIG_9

FIG_10

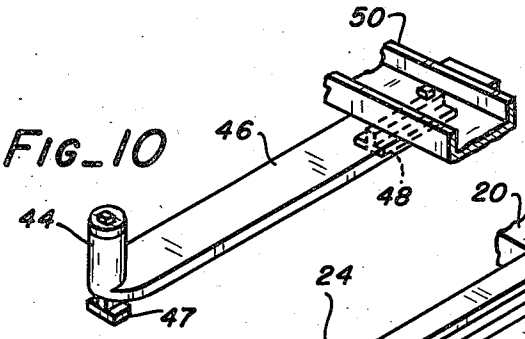


FIG_11

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Patented Apr. 30, 1946 2,399,348

UNITED STATES PATENT OFFICE

2,399,348

BENDING MECHANISM

Frank Hobbs, Seattle, Wash.

Application March 1, 1943, Serial No. 477,553

1 Claim. (Cl. 144—256)

This invention relates to a bending mechanism useful in the shaping of elongated structural members and more particularly applies to equipment for bending and clamping strip laminations in the formation of curved rib-like structural members.

An object of this invention is to provide a mechanism for bending elongated flexible members and to hold the attained bend while the member is being secured in that form, all without applying undue stresses or strains to the member.

Another important object of the invention is the provision of a mechanism for bending elongated flexible members, each of which are composed of several strip laminations, and which mechanism will gather and bend the same and hold them while they are being anchored together in shape.

Still another object of the invention is the provision in a bending mechanism for laminated elongated flexible members of frictionless presser means acting to bend said members and still insuring proper bending and adaptation of the various lamina to the desired shape.

Another important object of the invention is to provide, in a mechanism of the above nature, means for gathering the several lamina of a composite elongated member comprised of several flexible strips in a manner whereby misalignment is avoided and yet the accommodation of the strips together is insured.

The foregoing objects and other ancillary thereto I prefer to accomplish as follows:

According to a preferred embodiment of my invention, I provide a base frame upon which is mounted the operable elements of my bending mechanism. The base frame supports a plurality of parallel guideways in each of which is a reciprocally movable presser horn. Fixed horns are also mounted upon the table in opposition to the movable horns. Between the fixed and movable horns strip laminations are placed, curved and clamped to a desired shape for either subsequent assembly operation or for finally setting in the attained form. The movable presser members are coupled to a beam with which is associated means for moving the same in a steady but rapid sweep across the table to uniformly advance the movable horns toward the fixed horns. The means for moving the beam is so arranged that it may be remotely controlled by an operator and advanced or retracted at will. The mounting of the fixed horns upon the table is such that their arrangement can be varied to meet any of several desirable shapes. Likewise the pattern of the horns can also be varied in accordance with the shape of the structural member to be bent and clamped in this mechanism.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claim. The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in connection with the accompanying drawings, in which

Figure 1 is a plan view of my bending mechanism, with portions omitted for convenience of illustration;

Figure 2 is a plan view similar to Figure 1, but with the movable elements shifted to the clamping position;

Figure 3 is a fragmentary perspective view of the work surface of my bending mechanism;

Figure 4 is a perspective view of the base frame of the bending mechanism;

Figure 5 is a sectional view taken in the plane indicated by lines 5—5 of Figure 3;

Figures 6, 7 and 8 are detailed sectional views taken on the planes indicated respectively by lines 6—6, 7—7 and 8—8 of Figure 5;

Figure 9 is a perspective view of a fixed horn of my bending mechanism;

Figure 10 is a fragmentary perspective view of a movable horn of my bending mechanism;

Figure 11 is a perspective view of a guideway employed in my bending mechanism; and

Figure 12 is a perspective view of a structural member formed on the mechanism according to the present invention.

In Figure 4 I illustrate a base frame upon which is mounted the operating elements of my bending mechanism. The frame comprises a plurality of longitudinal members **20** having upright legs **22** and a forwardly extending overhanging ledge portion **24**. Cross members are indicated by the numeral **26**.

Upon this frame is mounted a plurality of guideways such as is shown in Figure 11. In this specific embodiment, each guideway comprises a pair of T-members **28, 28** which are anchored at the rear end upon the longitudinal rail **20** and upon the forward end to the overhanging member **24**. These guideways are arranged in parallelism across the surface of the table preferably at right angles to the longest dimension thereof. I tie the forward end of the guideways together and enclose them by means of the curved plate **30** shown throughout the drawings. The

operator or operators of my bending mechanism are normally positioned adjacent the curved plate **30**, to which I refer as the front of the mechanism.

Near the front end of each guideway is mounted a fixed horn either **32** or **34**. Either horn comprises a base plate **35**, standing stud **36**. A clamp bolt **38** passes through the base **35** and through a clamp plate **39** and a nut **40** retains the horn in fixed position as positioned by the operator. The horns are preferably cylindrical in shape or, at least, have a curved surface on the opposed faces to allow frictionless movement of the elongated flexible member during bending. Horn **34** in distinction to horn **32** has a cap **37** and a rearwardly extending finger **42** for a purpose later to be described. These fingers are shown only on certain of the fixed horns. The lower side of each finger outwardly a distance from the horn has a straight clamping portion parallel to the guideways. The outer end of each finger has its lower side upwardly curved to form a cam surface.

In opposition to each fixed horn in the guideway is mounted a movable horn **44** which is supported by an arm **46** having on its under side tongue members **47** and **48** which slide along the under side of the opposed flanges of the T-members **28, 28**.

The several arms **46**, having forward extensions of variable length, are joined at or adjacent their rear ends to a cross beam **50** which is here shown to comprise a channel iron that extends substantially the full length of the machine.

At suitable places along the length of the channel iron I mount depending arms **52** to each of which is coupled the rod **54** of piston **56**. Piston **56** lies within the chamber of hollow cylinder **58** that is joined by member **59** to one of the elongated structural members **20** of the machine. As can be seen in Figure 4, a plurality of the fluid cylinders **58** may be employed, in which event they are connected in parallel circuit by means of fluid conduits **60, 62** that join at valve **64** with a supply and discharge conduit **66**. Through this mechanism the rod **64** may be advanced or retracted at will in a uniform manner and cause the channel iron **50** to sweep forwardly or backwardly across the work table.

As has been suggested in Figure 1 in dotted lines and as shown in Figure 2 in solid lines, a rib comprises a plurality of laminated strips between each of which adhesive is placed. The laminations thus grouped are laid upon the upper surface of the work table between the fixed and movable horns when the latter are spread apart. The horns are then brought together so that the strip laminations are pressed against the fixed horns by the movement of the movable horns. When the horns are arranged in a curve the laminations are thus forced to a desired curved shape. Since my machine is particularly useful in the formation of curved ribs, I have so illustrated it and will so describe it, but it will be apparent that alternative shapes may be produced without departing from the principles of the invention.

As the strip-like laminations are advanced toward the fixed horns, it often occurs that, due to internal stresses and the like, they tend to misalign and be squeezed upwardly. This is additionally facilitated by reason of the lubrication provided by the adhesive between the laminations. To combat this condition I employ the rearwardly extending finger **42** which gathers the strips and, as they are advanced under the fingers, presses them down by action of the cam surface of each finger and retains them in under the straight clamping portion of each finger against the upper surface of the guideways. In the clamped position the strip-like members are then pinned together by nailing or stapling, producing a curved rib such as R shown in Figure 12. I also attach one or more chordlike members C to maintain the curvature of the so-formed ribs during setting of the adhesive.

When it is desired to remove the ribs from the clamping forms, the operator merely reverses the action of the cylinders **58**, causing the traveling beam **50** to return rearwardly across the table and to retract the movable horn from the fixed horns. The rib can then be lifted off the table and placed in drying racks or otherwise transported where desired.

Although I have shown and described certain specific embodiments of my invention, I am fully aware that many modifications thereof are possible. My invention, therefore, is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claim.

I claim:

A mechanism for bending elongated flexible members, comprising: a work surface having a plurality of guideways thereacross, an upstanding horn fixedly mounted in each said guideway to provide in plurality a predetermined pattern defining a shape to be applied to a flexible member, a rail movable in each guideway and mounting an upstanding horn, said horns movable with the rails being arranged in a pattern complementary to that of the fixed horns, a cross beam lateral of said work surface and the guideways and having said rails attached thereto, means for reciprocating said cross beam across said work surface whereby the horns movable therewith are caused to approach or recede from said fixed horns, and fingers carried by certain of said horns each of said fingers extending from the upper portion of its horn toward its opposite horn, and each finger having on its lower side a clamping portion outwardly from its horn and an upwardly curved cam surface at its outer end, said fingers being operable upon an elongated member being bent by the closing together of the movable to the fixed horns to depress said member toward the work surface and to clamp it there.

FRANK HOBBS.