Dec. 11, 1956 E. S. SMITH 2,773,527

WORK PIECE MOUNTING APPARATUS

Filed Jan. 5, 1954 2 Sheets-Sheet 1

Fig. 1

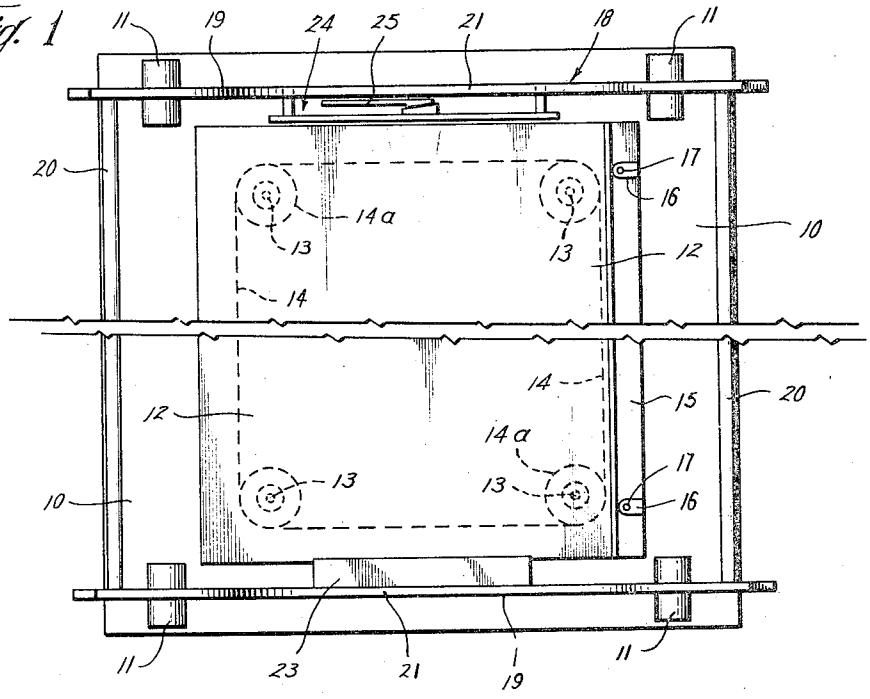
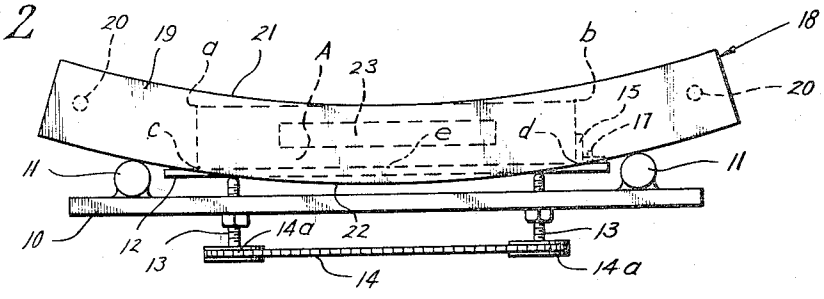


Fig. 2



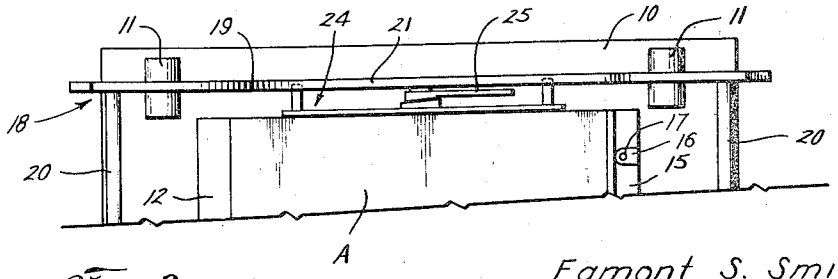


Fig. 3

Egmont S. Smith
INVENTOR.

BY

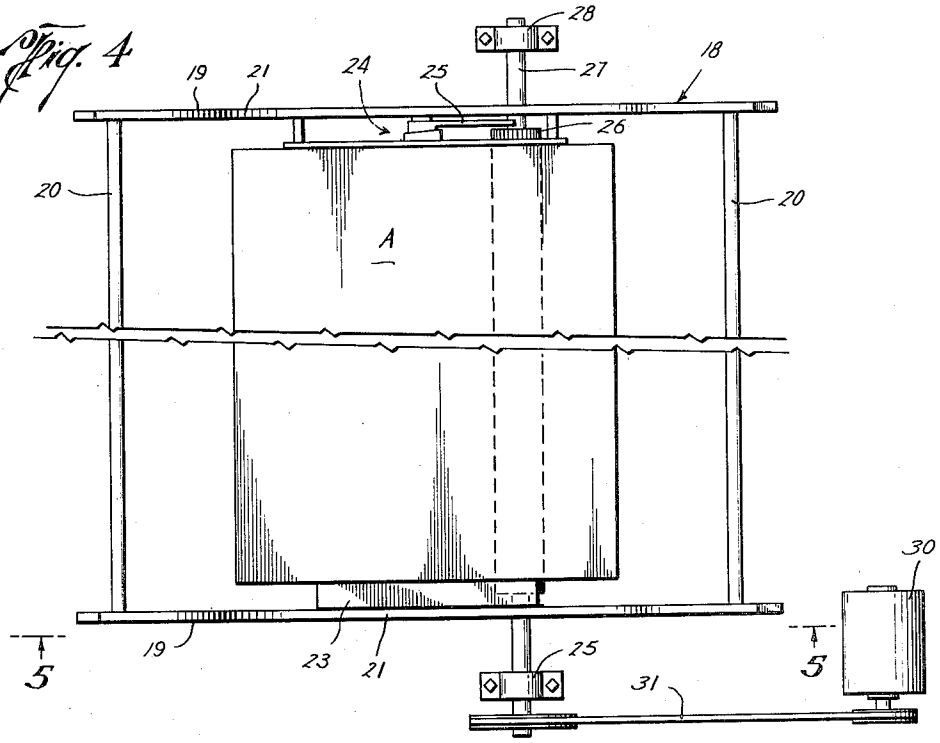
Browning, Sears & Hyer
ATTORNEYS

Dec. 11, 1956 E. S. SMITH 2,773,527

WORK PIECE MOUNTING APPARATUS

Filed Jan. 5, 1954 2 Sheets-Sheet 2

Fig. 4



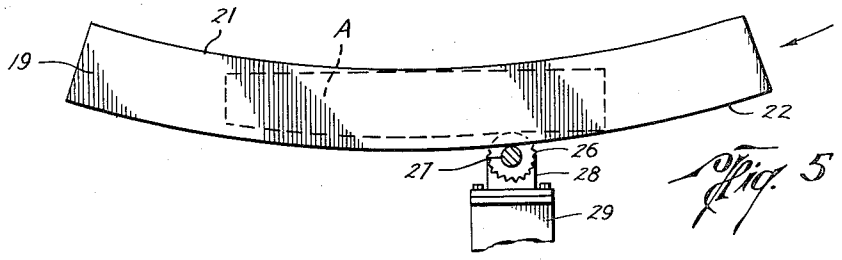


Fig. 5

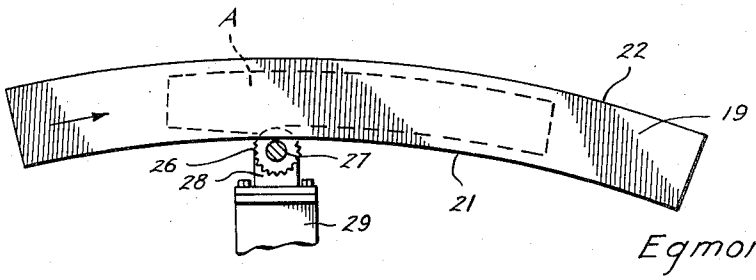


Fig. 6

Egmont S. Smith
INVENTOR.

BY

Browning, Simms & Hyer
ATTORNEYS

United States Patent Office 2,773,527 Patented Dec. 11, 1956

2,773,527

WORK PIECE MOUNTING APPARATUS

Egmont S. Smith, Houston, Tex., assignor to B. & B. Engineering & Supply Company, Inc., Houston, Tex., a corporation of Texas

Application January 5, 1954, Serial No. 402,271

13 Claims. (Cl. 144—145)

This invention relates to improved apparatus for mounting a work piece such that a cutting or grinding element can be worked over a surface of the work piece to shape the same to a predetermined curvature.

As an example of the utility of the apparatus of this invention, in the construction of cylindrical tanks and the like, sheets or blocks of a suitable insulating material are frequently employed to cover the tank walls. It is desirable, of course, that these sheets fit snugly and as closely as possible to the cylindrical surfaces of the tank walls. Inasmuch as this insulating material is normally fabricated in flat sheet or block form, at least the inner surface thereof which abuts against the tank wall must be shaped to a curvature conforming to that of the walls. If the outer surface of the insulating material is to be treated or covered in any way, it also is preferably shaped to a corresponding curvature.

According to one known method of shaping a surface of a sheet of insulating material, the sheet is mounted in a frame construction having templates at opposite sides thereof. A grinding or cutting element may then be guided by one edge of each of the templates, which edge is contoured to the desired curvature, to remove a portion of a surface of the sheet mounted between the templates thereby shaping the surface to the curvature of the templates. However, in the use of a frame construction of this type to shape the surfaces of a plurality of sheets, each sheet must be accurately positioned within the frame. That is, in order that only a predetermined portion of the surface of the sheet be removed in the shaping operation, it is necessary that the sheet be mounted in a predetermined location relative to the frame. This operation is both time consuming and subject to error and not at all conducive to high speed production of a uniform product.

It is an object of this invention to provide apparatus, including an improved frame construction of the general character above described, which will enable a sheet of insulating material or the like to be properly and quickly mounted in the frame in a new and improved manner so as to permit high speed production of shapes of such material.

It is another object of this invention to provide novel apparatus of the character above described in which the frame construction need only be located in substantially random fashion with respect to the work piece to be shaped prior to affixing the work piece firmly within the frame.

Another object of this invention is to provide improved apparatus of the character above described which obviates the necessity of precisely locating a work piece between or along cutting templates while at the same time insuring that the work piece is properly located prior to the shaping thereof.

Still another object of this invention is to provide a frame construction of the general character described by means of which opposite surfaces of a work piece

mounted therein can be contoured to concentric curvatures of respectively constant radii in a new and improved manner.

Still another object of this invention is to provide novel support means for a work piece supporting frame and template construction whereby the work piece can be mounted within the frame in an improved manner.

A still further object of this invention is to provide novel apparatus of the character described, a preferred embodiment of which includes a support having spaced bearing portions, a work piece supporting platform arranged on said support between said bearing portions, a frame construction including template means having at least two edges contoured to a constant radius curvature, and means associated with the templates for fixedly locating a work piece with respect thereto, the bearing portions and platform being arranged and constructed so that a work piece supported on the platform will be automatically properly located with respect to the frame when the frame is placed in substantially random fashion upon the support and around the work piece, with its contoured template edges resting upon the bearing portions.

Other objects, advantages and features of this invention will be more apparent to one skilled in the art upon a consideration of the specification and description of the drawings to follow.

Stated briefly, the novel apparatus of this invention includes, in a preferred form, a support having bearing portions which provide spaced bearing points lying in a plane of common curvature and upon which a frame member can be positioned above the support. The frame member includes template means each having at least one edge contoured to a constant radius curvature such that the template edges can be placed in substantially random fashion upon the bearing points to suspend the frame member above the support with the assurance that the center of curvature of the template edges will at all times be located in the same position relative to the support. The support also includes a platform upon which the work piece can be supported between the bearing portions and relative to the frame member resting thereon in such a manner that the work piece can be fixedly located with respect to the frame in such a position that a subsequent shaping operation will remove only a desired portion of the work piece.

While this invention finds particular application in the shaping of surfaces of sheets of insulating material for the purposes described, its scope is not restricted thereto. To the contrary, the apparatus of this invention may also be used in shaping the surface of other types of sheet material to a constant radius curvature. Still further, the application of this invention is not necessarily restricted to the shaping of surfaces of "sheet" material, as the term is commonly used to denote a configuration having a relatively high ratio of length or width to thickness. Actually, this invention is applicable to the contouring of a work piece of almost any configuration. For that reason, in the description to follow and claims of this invention, the term "work piece" is used throughout. However, as will be more fully understood hereinafter, the apparatus of this invention may be practiced only with respect to work pieces of relatively rigid characteristics. That is, the work piece must be of a material which will not only resist bending along its length due to its own weight but also bending or compression as a result of ordinary endwise clamping pressure.

In the drawings, wherein like reference characters are employed throughout each of the views:

Fig. 1 is a plan view of a preferred embodiment of the novel apparatus of this invention;

Fig. 2 is an elevational view of the apparatus of Fig. 1,

with a work piece supported in operative position thereon;

Fig. 3 is a partial plan view similar to Fig. 1, but in which the work piece has been clamped in position within the frame construction of the apparatus;

Fig. 4 is a plan view of the frame construction removed from the support therefor and with a surface of the work piece carried thereby in the process of being worked by a cutting element;

Fig. 5 is a partial elevational view of the frame construction with one surface of the work piece being worked by the cutting element; and

Fig. 6 is a view similar to Fig. 5, but in which the opposite surface of the work piece is being worked.

Referring now particularly to the above described drawings, there is shown in Fig. 1 a substantially horizontal support **10** having four, at least three being required, spaced bearing portions **11** secured thereto at approximately the four corners of the support.

Disposed above the support **10** and between the bearing portions **11** is a platform **12** having an upper surface upon which a work piece A of insulating material or the like can be placed. This platform **12** is supported towards its corners by threaded rods **13** received as shown in the support **10** and caused to be moved uniformly vertically with respect thereto by a chain **14** engaging with sprockets **14***a* affixed to the lower ends of the rods. Thus, upon actuation of the chain **14**, the elevation of platform **12** with respect to the support **10** and portions **11** can be adjusted as desired while maintaining the supporting surface of the platform in predetermined angularity with respect to portions **11**.

When placed upon the platform **12**, an edge of the work piece A can be abutted against a stop member **15** for centering the work piece in one direction with respect to the platform. This stop member can be made adjustable with respect to the platform edge by means of slots **16** encompassing clamping bolts **17** upstanding from the platform.

The frame for mounting the work piece A is indicated in its entirety by the numeral **18** and includes laterally spaced parallel templates **19** which are rigidly maintained in their spaced relation by laterally extending tie rods **20**. When it is desired to shape the work piece to fit a cylindrical surface, the upper and lower edges **21** and **22**, respectively (Fig. 2) of each of the templates are all curved about a common axis with the curvatures of the upper edges each having the same radius and the radius of curvature of the lower edges also being equal to each other but greater than the radius of the upper edges. In this manner, both of edges **21** lie in a common cylindrical plane and both of edges **22** likewise lie in a common cylindrical plane, both of such planes being struck about a common axis on different radii.

A fixed abutment **23** is located along the inner side of one of the templates and an adjustable cam clamp **24** is located along the inner side of the other template and in opposed relation to the fixed abutment **23**. The clamp **24** can be operated by a handle **25** from an open position (Fig. 1) to closed position (Figs. 3 and 4) for clamping opposite sides of the work piece A to retain the latter in a fixed position within the frame **18**. In its alternate positions, the handle **25** is disposed horizontally so as not to interfere with the subsequent shaping operations.

Instead of connecting templates **19** directly to tie rods **20**, suitable side frame members of less depth than that of the templates can be connected to the tie rods and then the templates connected to the side frame members as by providing the templates with slots and the side frame members with bolts or studs. A number of differently curved templates can then be successively used with a single frame and have their positions on the frame adjusted to secure proper alignment of the curved edges of the templates.

From the foregoing, it will further be understood that with the work piece A located upon the support **10**, the frame **18** may be moved into position thereover and into contact with each of bearing portions **11**. In so placing the frame, it is only necessary that the template edges be placed in contact with all four bearing points and as long as this is accomplished, the frame will be properly located with respect to the work piece even though its location lengthwise with respect to the work piece may be selected in random fashion. That is, inasmuch as the edges of the templates **19** are contoured to constant radius curvatures about a single common axis and the bearing points of bearing portions **11** are situated so that all contact the respective lower edges of the templates (i. e., the bearing points also lie in a constant radius curved plane struck about the same axis as that of the templates), the templates will automatically be disposed so that the axis about which their edges are curved will always occupy the same position with respect to the work piece regardless of the location of the frame lengthwise of the support **10** and bearing portions **11**. Then by properly adjusting the position of platform **12** and stop **15**, as discussed below, succeeding similarly shaped work pieces will always be clamped in the frame so that each will be cut like the others thereby providing a uniform, accurately cut product.

Thus, the contoured edges of the templates **19** may be said to perform a dual function. Those portions of the edges which rest upon bearing portions **11** act to automatically position the frame with respect to the work piece. On the other hand, the edges serve to guide a cutting or grinding member in shaping a surface of the work piece. As a practical matter then, it is desirable to provide templates **19** for the frame which are sufficiently long to extend considerably outwardly beyond the ends of the work piece and to space bearing members **11** a substantial distance inwardly from the ends of the templates. In this manner, an operator is given wider latitude in adjusting the lengthwise placement of frame **18** upon the bearing members.

With the work piece A located in selected position on the platform **12**, as discussed below, and the frame **18** randomly located upon and touching each of the bearing portions **11**, the work piece can be fixedly located with respect to the frame by operation of the cam clamp **24**. At this time, both the frame and work piece can be lifted as a unit from the support **10** and carried to a convenient location for shaping the surfaces of the work piece. For this purpose, there can be provided a cutting or grinding roller **26** (Figs. 4 to 6) having either an abrasive or milling surface thereon. This roller can be mounted on a shaft **27** having its opposite ends journaled in bearings **28** supported on uprighhts **29**. A motor **30** may be provided for driving the cutting roller **26** through a belt **31**.

Thus, as shown in Figs. 5 and 6, the upper and lower edges **21** and **22** of the templates **19** may be alternately traversed by the shaft **27** such that the roller **26** is caused to cut or grind away a contour on each of the surfaces of work piece A, which contour corresponds to that of the template edges.

From the foregoing description, it will be understood that the elevation of the platform **12** may be adjusted in such a manner with relation to the bearing portions **11** that when a work piece A of predetermined thickness is supported thereon and frame **18** is rested upon the bearing portions, the work piece can be fixedly located with respect to the frame in such a position that its upper and lower surfaces can be shaped. To effect a minimum wastage of material, the width of the templaes between their edges **21** and **22** is selected to be equal to the sum of the desired thickness of the finished work piece product plus twice the distance which cutting roller **26** extends into the frame beyond the edges of the templates. A work piece is then selected to have a thickness at least as great and preferably substantially equal to the template

width less the distance roller 26 extends into the frame. Stop 15 is adjusted so that the ends of the work piece are spaced an equal distance from a plane normal to platform 12 and containing the common axis of curvature of template edges 21 and 22 when positioned on bearing portions 11. Thus, with the four bearing portions 11 located at the corners of a rectangle as shown in the drawings, the work piece will be centered lengthwise between the pairs of the bearing portions at opposite ends of the frame. The height of platform 12 is adjusted so that the roller takes no more than a very shallow cut at corners *a* and *b* of the work piece and a maximum cut midway between these corners. Conversely, when shaping the other side of the work piece, this adjustment is such that the cutter takes a maximum depth of cut at corners *c* and *d* and a minimum at midway point *e* therebetween. Thus, the height of platform 12 can be adjusted to place points *a*, *b* and *e* equidistant from the respective edges of the templates. Such height adjustment is usually necessary each time the thickness of the work piece or the width of the templates is changed.

If desired, the elevation of the bearing portions 11 rather than the elevation of the platform may be made adjustable. On the other hand, both the bearing portions and the platform may be made adjustable.

As shown in the drawings, the portions 11 are cylindrical and of equal diameter and extend transversely of the length of the support. As well, the axes of laterally opposite bearing portions are aligned with each other so that each portion provides a line or point for contacting and supporting the templates of frame 18. With this arrangement it will be noted that all of the lines or points for supporting the frame lie in a common plane of constant radius curvature struck about an axis which will coincide with that of the curvatures of template faces 21 and 22 when the frame is properly positioned in contact with each of the supports. Of course, if desired, each pair of opposite bearing portions may merely comprise a single cylindrical member extending entirely across the support 10.

As well, it will be understood that the bearing portions 11 need not necessarily be four in number, three being sufficient if stops are provided to align the frame each time it is placed on the three bearing portions so that the axis about which the template edges are struck will always assume the same position each time the frame is placed on the three bearing portions.

The bearing portions need not be of cylindrical shape. To the contrary, they may be of any shape and size to provide the lines or points disposed to contact the lower edges of the templates and permit the latter to slide lengthwise on the portions without shifting the axis about which the template edges are struck. Preferably, however, four bearing portions are provided to eliminate the need for aligning stops and to give more flexibility in lateral placement of the frame on the bearing portions since when the frame is placed so that it contacts all four bearing portions, one can be assured that the common axis about which the template edges are struck will always assume the same position each time the frame is placed on the four bearing portions. As well, in the illustrated embodiment of this invention, the bearing portions 11 are raised sufficiently above the flat support 10 to permit frame 18 to be suspended therebetween and above support 10. As will be undersood, the height of the bearing portions will be dependent upon the location of the support relative thereto as well as the shape of the frame and in this sense, a plurality of sets of bearing portions can be provided on the support to accommodate frames of widely varying sizes and shapes.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the apparatus.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. An assembly for use with apparatus for shaping a surface of a rigid work piece, said assembly comprising in combination, a support carrying a platform for supporting a work piece having a surface to be shaped, a frame including template means having edges contoured to a constant radius curvature, means for removably receiving said frame upon said support with said contoured edges in selected orientation relative to said platform, said latter-mentioned means including bearing portions carried by said support providing at least three bearing points for said frame which determine the position of said contoured edge relative to said platform, and means on said template means for fixedly clamping said work piece therebetween.

2. An assembly of the character described in claim 1, said means for removably receiving said frame upon said support also including bearing parts on said frame which engage with the bearing points provided by the bearing portions carried by the support.

3. An assembly of the character described in claim 2, in which the bearing parts on the frame comprise contoured elongated portions having a common center of curvature with the contoured edges of the template means.

4. An assembly for use with apparatus for shaping a surface of a rigid work piece, said assembly comprising in combination, a support having spaced laterally extending bearing portions, a work piece supporting platform between said bearing portions, a frame including spaced templates having the lower edges thereof contoured to a constant radius curvature, said templates being longitudinally suspendable between said spaced portions and above said support, said frame to be positioned in selected orientation relative to said platform, and means on said templates for fixedly clamping said work piece therebetween.

5. An assembly of the character described in claim 4, in which the opposite upper edges on said templates are also contoured to a constant radius curvature, said upper and lower contoured edges having a common center of curvature.

6. An assembly of the character described in claim 4, said bearing portions being constructed to provide line contact with the edges of said templates longitudinally suspendable therebetween.

7. An assembly for use with apparatus for shaping a surface of a rigid work piece, said assembly comprising in combination, a support including spaced bearing portions thereon, a work piece supporting platform between said bearing portions, a frame having spaced templates extending longitudinally between and suspended from said bearing portions, said templates being disposable in selected position laterally of the support and along said bearing portions to orient the frame relative to said platform, and means on said templates for fixedly clamping said work piece supported on said platform to said frame.

8. An assembly of the character described in claim 7, in which said templates are suspendable from said bearing portions along edges of said templates, said edges being contoured to a constant radius curvature.

9. An assembly of the character described in claim 8, in which the edges of said templates opposite to those suspended from said bearing portions are also contoured

to a constant radius curvature, each of said contoured edges having a common center of curvature.

10. An assembly of the character described in claim 8, said bearing portions being constructed to provide line contact with the template edges suspended therefrom.

11. In combination, template means for use with a shaping tool in shaping a face of a work piece to a constant radius curvature and means for temporarily supporting the template means and work piece while the work piece is fastened in the template, said supporting means having a platform for supporting a work piece and at least three bearing points for supporting the template means, said template means having spaced elongate template members extending substantially parallel to each other, each of said template members having a surface contoured to a constant radius curvature about a common axis, said surfaces adapted to rest on said bearing points to position the template relative to the support while the work piece is being clamped therein, and clamping means carried by the template means for clamping the work piece thereto with the work piece positioned at random along the length of the template members.

12. The combination of claim 11 wherein the clamping means is provided by opposed abutments at least one of which is selectively movable toward the other to clamp a work piece therebetween, said abutments having abutment faces extending substantially parallel to the template members.

13. The combination of claim 11 wherein said platform is provided with a stop element extending normal to said template members when the template means is positioned on the support means to center the work piece between said bearing points.

References Cited in the file of this patent

UNITED STATES PATENTS

444,306	Rohlmann	Jan. 6, 1891
1,364,196	Heath	Jan. 4, 1921
1,551,178	Strand	Aug. 25, 1925
2,664,122	Allen	Dec. 29, 1953