Jan. 28, 1964 D. C. CAMPBELL 3,119,724

METHOD AND APPARATUS FOR STACK CUTTING METAL SHEETS AND PLATES

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FIG. 1.

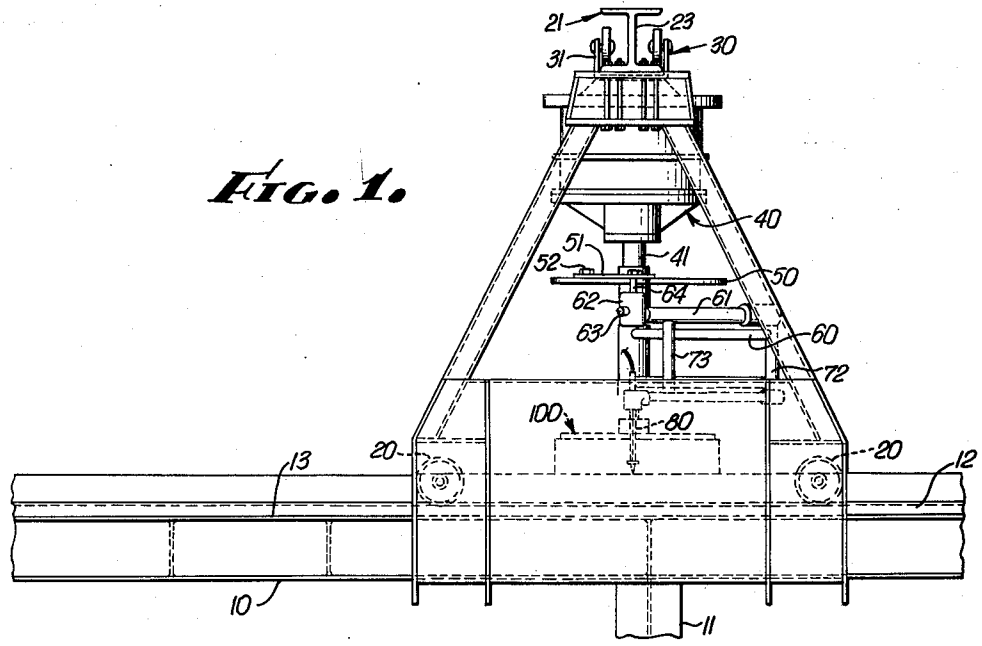
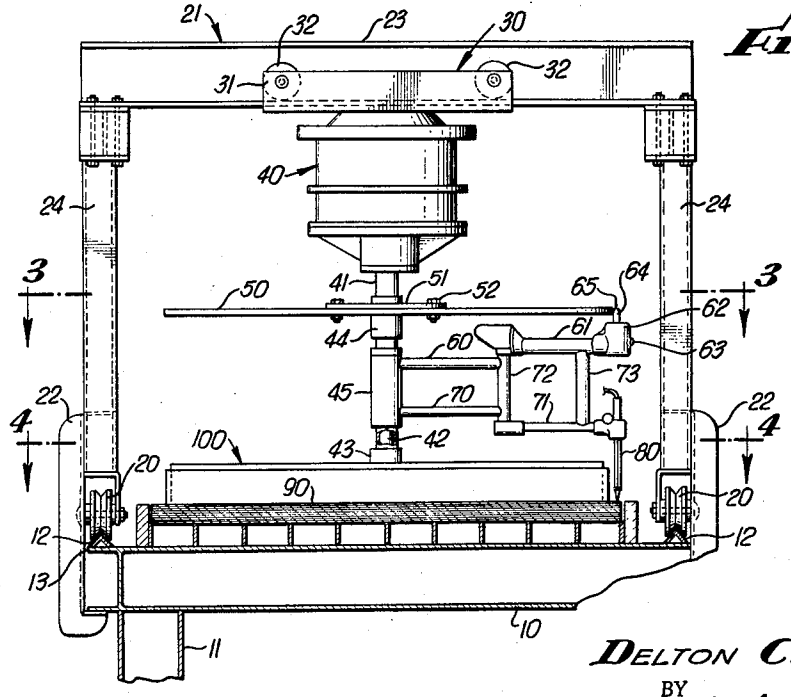


FIG. 2.



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FIG. 3.

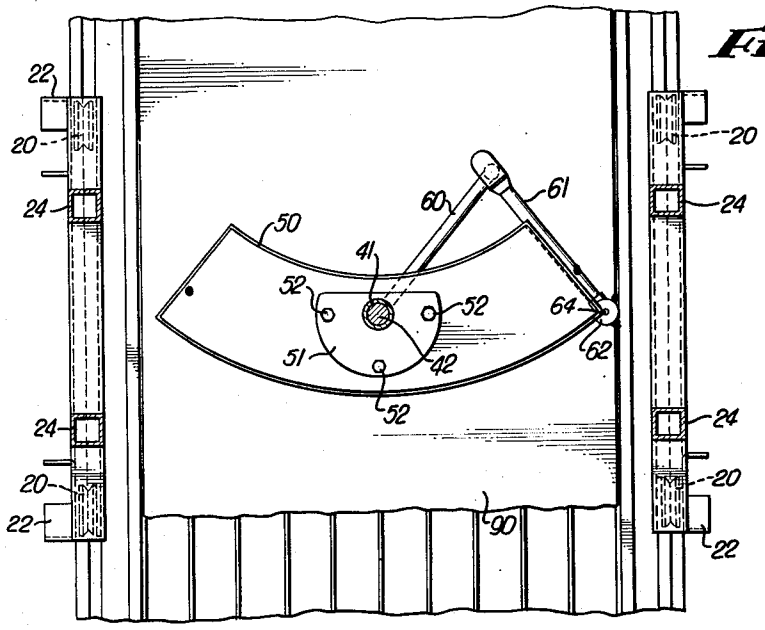


FIG. 4.

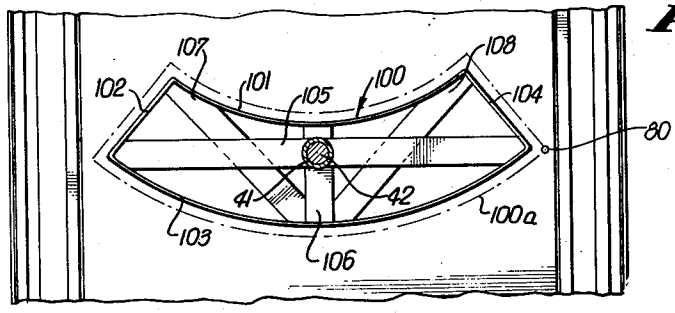


FIG. 5.

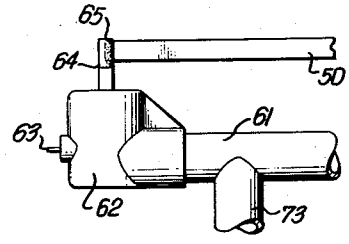
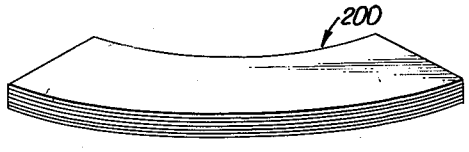


FIG. 6.



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United States Patent Office 3,119,724 Patented Jan. 28, 1964

3,119,724

METHOD AND APPARATUS FOR STACK CUTTING METAL SHEETS AND PLATES

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Filed Oct. 19, 1961, Ser. No. 146,235
8 Claims. (Cl. 148—9)

This invention relates to a method of simultaneously producing a plurality of forms cut from metal sheets or plates, and the apparatus for performing said method. More particularly, it relates to a method and apparatus for simultaneously producing such forms from a stack of overlying sheets or plates.

There are many devices and methods, many of them quite complicated, for automatically cutting or burning sheet metal and plate wherein the torch follows a template to produce a form from a single sheet or plate, but until the present invention no satisfactory method or device has been offered which will quickly and easily produce a plurality of forms from a plurality of sheets or plates stacked one upon the other, with a single cutting.

Stack burning, when attempted, has not been fully satisfactory because it has been difficult to retain the sheets or plates tightly compressed to each other at the line of burning during the cutting process, so as to permit an accurately aligned cut on all sheets or plates simultaneously and prevent blow-out between sheets or plates, which occurs if they are not tightly compressed.

It is therefore an object of the present invention to provide a method and apparatus for cutting through a stack of metal sheets or plates so as to simultaneously produce a plurality of forms of the same configuration and of exact tolerances.

It is another object of the invention to provide such a method and apparatus wherein said sheets or plates are effectively compressed together during the cutting operation.

It is still another object to provide an apparatus for performing the method of the invention which is uncomplicated and easy and inexpensive to construct, install and operate.

It is a further object to provide a method of stack burning which is quick and easy to perform, but which simultaneously produces a plurality of accurately cut products.

With these and other objects in view, the invention consists of the construction, arrangement and combination of the various parts of the device whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims, and illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a side elevational view of the device of the present invention.

FIGURE 2 is an end elevational view of the device.

FIGURE 3 is a view taken on the line 3—3 of FIGURE 2.

FIGURE 4 is a view taken on the line 4—4 of FIGURE 2.

FIGURE 5 is a detailed side elevational view of the driving means of the device of the present invention.

FIGURE 6 is a perspective view of a stack of forms processed by the method and apparatus of the present invention.

A bench **10**, which may be supported on legs **11**, has rails **12** mounted adjacent its longitudinal edges **13**, said rails **12** extending over substantially the entire length of bench **10**.

Rollers **20** are mounted on said rails **12** and support a carriage **21**. Carriage **21** comprises side members **22** disposed externally of edges **13** of bench **10**, on which said side members **22** rollers **20** are rotatably mounted; a cross-rail **23**, which is disposed in spaced transverse relationship to bench **10**; and support members **24**, which are mounted on side members **22** and support cross-rail **23**.

A carriage **30** has a body frame member **31** on which are rotatably mounted rollers **32**. Rollers **32** are disposed on cross-rail **23**.

Mounted on carriage **30** is a fluid cylinder assembly **40**. Depending from cylinder assembly **40** is a hollow shaft **41**, in which a piston rod **42** is disposed. A piston **43** is mounted on the lower end of piston rod **42**. A collar **44** is mounted on shaft **41**, and a rotating collar **45** is also mounted on shaft **41**, below collar **44**.

A template **50** is mounted in horizontal position on collar **44**, preferably at a generally centrally located point on template **50**. Mounting of template **50** on collar **44** may be by any suitable means, the mounting illustrated in the drawings being by means of a centrally bored plate **51**, collar **44** being disposed in the bore of plate **51**, and plate **51** being secured to template **50**, as by fasteners **52**, said plate **51** being disposed so as to cover a suitable opening in template **50**.

Articulated support arms **60** and **61** are mounted on rotating collar **45** and extend outwardly therefrom. They support a variable speed motor **62** which may be equipped with a rheostat **63**. Projecting upwardly from motor **62** is a drive shaft **64**, disposed so that said drive shaft **64** will make contact with the edges of template **50**. The upper end **65** of drive shaft **64** is magnetized so as to be attracted to and maintained in position in contact with the edges of template **50**.

In order to provide stability, in lieu of a single pair of articulate arms, another pair of articulate arms **70** and **71** may be similarly mounted on collar **45**, but spaced apart from and below arms **60** and **61**, said four articulate arms being joined by transverse rods **72** and **73**.

Arm **71** supports a cutting torch **80**, which is substantially aligned wtih drive shaft **64**. The operating head **81** of torch **80** is suspended below arm **71**.

A stack **90** of sheets or plates is disposed on bench **10** between edges **13**, said stack **90** being straddled by carriage **21**.

A hold-down assembly member **100**, best illustrated in FIGURE 4 of the drawings, is placed on top of stack **90**, in position under cross-rail **23** of carriage **21**. Hold-down assembly member **100** may be of any suitable configuration, but it has been found to be preferably, in order to insure firm downward pressure closely adjacent to a proposed cutting line **100***a*, while still leaving space for the unobstructed movement of head **81** of torch **80**, to provide a hold-down assembly member which is of a configuration substantially similar to the configuration of template **50**, but of reduced size. Hold-down assembly **100**, as illustrated in FIGURE 4, has edge members **101**, **102**, **103** and **104**, longitudinal cross-brace **105**, intersecting cross-brace **106** (which intersects cross-brace **105** at approximately the middle of cross-brace **105** to form a seat for piston **43**, as hereinafter mentioned), and oblique cross-braces **107** and **108**, but the hold-down assembly herein described is merely illustrative, and any other hold-down assembly may be used, provided it is sufficiently strong to receive fluid pressures of sufficient intensity to permit it to firmly compress the sheets or plates in stack **90** closely adjacent the proposed cutting line and and prevent blow-out between the sheets or plates during the burning-cutting operation hereinafter described. It will also be recognized that if desired a solid hold-down member may be used.

In operation, a stack **90** of sheets or plates having been disposed on bench **10**, carriage **21** is moved along rails **12**

until carriage 21 is in straddling position over stack 90 at a place where form cutting is to be made. Carriage 30 is then moved along cross-rail 23 until carriage 30 is disposed over the approximate center of the proposed form to be cut. Template 50 is then aligned, and hold-down assembly 100 is placed on stack 90 and aligned with template 50 so that hold-down assembly 100 will be disposed on stack 90 closely adjacent to, but spaced apart from, proposed cutting line 100*a*.

Fluid pressure is then exerted in fluid cylinder assembly 40 to impel piston rod 42 and piston 43 mounted thereon toward hold-down assembly 100, such fluid pressure being continued until piston 43 is firmly seated on hold-down assembly 100, said fluid pressure being continued during the entire cutting operation so that hold-down is firm and complete.

By manipulation of arms 60, 61, 70 and 71, upper end 65 of drive shaft 64 of motor 62 is brought into contact with the edge of template 50. Contact of end 65 with template 50 is maintained by magnetic attraction.

On manipulation of arms 60, 61, 70 and 71 to bring end 65 of drive shaft 64 into contact with template 50, torch 80, supported by said arms 60, 61, 70 and 71 will be disposed over proposed cutting line 100*a*. Operating head 81 of torch 80 is then brought into contact, or close proximity to stack 90 in accurate alignment with proposed cutting line 100*a*.

Rheostat 63 of motor 62 is adjusted, dependent on the hardness and thickness of the sheets or plates in stack 90 which are to be cut.

When motor 62 is energized, magnetized end 65 of shaft 64 will proceed to move at predetermined speed around the edges of template 50, moving arms 60, 61, 70 and 71, which in turn will move operating head 81 of torch 80 in a path along cutting line 100*a*. Torch 80 will cut through the entire stack 90, and the path of cut will correspond to the configuration of template 50. During the entire cutting operation the sheets or plates in stack 90 will be firmly held against buckling, expansion, or other movement by the hold-down action of hold-down assembly 100.

When end 65 of shaft 64 has moved around the entire edge surfaces of template 50, a corresponding full cut will have been made by torch 80. Motor 62 is then de-energized, and fluid pressure is relieved in fluid cylinder assembly 40. Hold-down assembly 100 is then removed from stack 90. The resulting stack of accurately cut forms thus produced, such as stack 200 illustrated in FIGURE 6 of the drawings, may then be removed from bench 10, and if desired, by movement of carriage 21 to another location along rails 12, the cutting operation may be repeated at another part of stack 90.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent structures and methods.

What is claimed is:

1. A method of simultaneously producing a plurality of forms cut from metal sheets or plates which comprises the steps of: forming a flat stack of pieces of the material to be cut; suspending a template over said stack; applying to said stack hold-down means of a configuration similar to but smaller than said template; aligning the hold-down means closely adjacent to a cutting path; aligning a cutting torch with said template; applying automatic template following means to the torch, said means automatically following the template so as to allow the torch to cut in a pattern corresponding to the peripheral contour of the template; energizing said torch; and driving said torch along a cutting path in close proximity to the outside edges of said hold-down means so as to cut through said stack in a pattern determined by said template.

2. The method of claim 1, including the step of applying pressure to said hold-down means during the cutting operation so as to prevent movement of pieces in said stack relative to each other.

3. The method of claim 2, wherein said pressure is fluid pressure.

4. Apparatus for simultaneously producing a plurality of forms cut from metal sheets or plates which comprises: a bench for supporting a flat stack of pieces of material to be cut; rails mounted longitudinally adjacent the edges of said bench; a first carriage movably mounted on said rails and straddling said bench and said stack; a second carriage supported by said first carriage in suspended position over said bench and movable on said first carriage transversely to said bench; a fluid cylinder assembly mounted on said second carriage; a hollow shaft mounted on and depending from said fluid cylinder assembly; a piston rod disposed in said fluid cylinder assembly and in said hollow shaft, and protruding from said hollow shaft; a piston mounted on said piston rod externally of said hollow shaft; a hold-down member seated on said stack and disposed so as to receive said piston when fluid pressure is exerted in said fluid cylinder assembly, said hold-down member being of a configuration substantially the same as, but slightly smaller than, the configuration of the template, and said hold-down means being disposed in vertical alignment with the template; a template mounted on said hollow shaft in spaced, substantially parallel relationship to said stack and in vertical alignment with said hold-down member; a cutting torch; means rotatably mounted on said shaft for supporting said torch in a pattern of travel determined by the periphery of said template; a motor mounted on the torch; and a projecting, magnetized drive shaft on the motor aligned with said torch and in contact with the periphery of the template so as to guide the torch in the pattern of travel determined by said periphery.

5. Apparatus for simultaneously producing a plurality of forms cut from metal sheets or plates which comprises: a bench for supporting a flat stack of pieces of material to be cut; a template suspended over said stack; hold-down means for compressing said pieces together, said hold-down means being of a configuration substantially the same as, but slightly smaller than, the configuration of the template, and said hold-down means being disposed in vertical alignment with the template; a cutting torch aligned with said template and disposed so as to cut through said stack in a pattern determined by said template and on a line in close proximity to said hold-down means; and a magnetized drive shaft mounted on the cutting torch and disposed so as to be attracted to and maintained in traveling position in contact with the edges of the template.

6. Apparatus for simultaneously producing a plurality of forms cut from metal sheets or plates, which comprises: a bench for supporting a flat stack of pieces of material to be cut; a first carriage supported by said bench, movable longitudinally thereon, and straddling said bench and said stack; a second carriage supported by said first carriage, suspended above said bench, and movable transversely in relation to said bench; a downwardly directed hollow shaft mounted on said second carriage; a template mounted on said shaft in substantially parallel relationship to said stack; a cutting torch; means rotatably mounted on said shaft for supporting and guiding said torch in a pattern of travel determined by the periphery of said template; a hold-down member disposed on said stack, said hold-down member being of a configuration substantially the same as, but slightly smaller than, the configuration of the template, and said hold-down member being disposed in vertical alignment with the template; and means associated with the hollow shaft for exerting hold-down pressure on the hold-down member.

7. Apparatus as defined in claim 6, wherein the means for guiding said torch comprises: a motor; and a project-

ing drive shaft on said motor in magnetized contact with the periphery of said template.

8. Apparatus as defined in claim 6, wherein said means for exerting hold-down pressure on said hold-down member comprises: a fluid cylinder assembly; a piston rod associated with said fluid cylinder assembly and disposed in and extending from said hollow shaft; and a piston mounted on said piston rod and seated on said hold-down member.

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